CORRELATION OF INTRAOPERATIVE FROZEN SECTION WITH HISTOPATHOLOGY

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Submitted By

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DECLARATION BY THE CANDIDATE

I hereby declare that the thesis entitled **"CORRELATION OF INTRAOPERATIVE FROZEN SECTION WITH HISTOPATHOLOGY"** submitted towards partial fulfillment of the requirements for the award of **M.D. IN PATHOLOGY** degree to BFUHS is a compilation of original work carried out by me under the supervision of **Dr. Bhavna Malhotra,** Professor, Department of Pathology, **Dr. Harpreet Kaur**, Professor and Head, Department of Pathology, & **Dr. Gurpreet Singh Brar,** Professor and Head, Surgical Oncology Unit, DMCH. No part of this thesis has formed the basis for the award of any degree previously.

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Dedicated

to

my family

&

Teachers

LIST OF ABBREVIATIONS

BSO	Bilateral Salpingo-Oophorectomy
CR	Concordance Rate
DPX	Distryrenedibutyl Phtalate Xylene
DR	Discordance Rate
FS	Frozen Section
H&E	Hematoxylin and Eosin
IOC	Intra-Operative Consultation
LAMN	Low Grade Appendiceal Mucinous Neoplasm
NPV	Negative Predictive Value
PFM	Positive For Malignancy
PPV	Positive Predictive Value
SFM	Suspicious For Malignancy
SLN	Sentinel Lymph Node
TAH	Total Abdominal Hysterectomy
TAT	Turn Around Time

ABSTRACT

Introduction: Tissue specimens taken from the patient while doing the surgery (frozen section) were studied and then correlated with the final histological examination.

Aims & Objectives: To study the indications of doing frozen sections and to compare the diagnostic accuracy of frozen section in various tissues by comparing it with final histopathology.

Material & Methods: This study was conducted in Dayanand Medical College and Hospital, Ludhiana for 1 year prospectively (1st March 2021-28th February 2022). Fresh tissue sent for frozen section examination, was examined grossly and sections were taken from representative areas. Then they were immediately stained with rapid hematoxylin and eosin (H&E) stain and Toludine blue stain. Frozen section diagnosis was made and immediately conveyed to the operating surgeon. For the permanent section, the remaining tissue was fixed in 10% formalin and grossed accordingly. The frozen section diagnosis was then compared to the permanent sections to assess the accuracy of the technique.

Results: We received a total of 183 cases out of which 46.5% were received for primary diagnosis, 34.9% were to look for metastasis and the remaining 18.6% were sent to assess the resected margin status. The overall concordance rate, discordance rate was 89%, 10.5% and 1 case was deferred for diagnosis. The overall sensitivity, specificity, PPV and NPV were 80%, 96.2%, 93.7% and 87.3% respectively. The various reasons for discordance were sampling error by surgeon [42.2%], sampling error by pathologist [36.8%], interpretation error [10.5%] and freezing artifacts [10.5%].

Conclusion: We conclude that frozen section is the best modality for knowing the resected margin status and is reliable and accurate for intraoperative evaluation of lymph nodes and the primary diagnosis of most tumors. Frozen section evaluation is an accurate mean of intraoperative diagnosis and its efficacy is validated at our centre.

Keywords: Frozen section, Histological, Accuracy

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INTRODUCTION

The pathologist typically evaluates a tissue sample obtained from the patient during a biopsy or surgery the following day, after the sample has been sufficiently fixed in formalin. Though sometimes, surgeons want an intra-operative consultation on the tissue being removed because they require pathologic information more rapidly (known as frozen section) while the patient is lying on the operating table. This entails gross examination and if the specimen is larger, sections from the representative areas are evaluated. Tissues must be hardened in order to be cut into thin slices with a thickness of less than 1 cell for microscopic analysis which can be achieved by freezing. The operating surgeon is then informed as soon as possible of the frozen section diagnosis through telephone or intercoms because the outcome significantly affect the surgeon's intra-operative decision. The pathologist is under time constraint to make the right choice based on his expertise, judgement, and understanding of clinical medicine and his area of expertise.

Pathological diagnoses were generally made postmortem before the 19th century. The father of pathological anatomy is Giovanni Morgagni. In the year 1761, he presented his 700 autopsies of clinical and gross pathological connection in his book, "The Seats and Causes of Disease."[1]

Karl Rokitansky, who proposed the first general classification of disorders between 1842 and 1846, is credited with establishing pathology as a distinct field of medicine.[2]

In 1891, William Halsted at the John Hopkins Hospital asked pathologist Welch to perform the first intraoperative frozen section on a patient with probable breast cancer.[3]

Louis B. Wilson published a frozen section technique in 1905 that takes only a few minutes to complete.[4]

Particularly with the development of the cryostat in 1959, this practise has been developed.[5] Hence, this development places the pathologist back on the operating room team where he originated.[6]

In western literature, the accuracy rates for frozen sections are extensively documented.[7-13]

There are numerous causes of doing frozen section are listed below:

*Determining whether a lesion is neoplastic or non-neoplastic and further whether it is benign or malignant is crucial for the operating surgeon since it will determine the sort of surgical technique or additional sampling that must be performed.

*To confirm the existence of a lesion or skip lesion in a suspected tissue area and to confirm the existence of a second lesion discovered incidently during surgery.

*Determining the adequacy of margins is crucial in cases with malignant tumours. If the resected margins are positive, the surgery is not done properly.

*To establish the proof of invasion to the nerve and lymph nodes as well as ascertaining metastases to distant organs is another use for it.

*To identify the cause of non-cancerous lesions and check for granulomas, fungal infection and tissue inflammation.

*In order to avoid transplanting organs to fail, it is vital to examine an organ before transplantation (<5%).[6]

The accuracy of the technique should be checked by comparing the frozen section with the final histopathological diagnosis.

AIMS & OBJECTIBES

1. To study the indications of doing frozen sections.
2. To know the diagnostic accuracy of frozen section by comparing it with histological examination of the specimen.

REVIEW OF LITERATURE

The pathologist typically evaluates a tissue sample obtained from the patient during a biopsy or surgery after the sample has been sufficiently fixed in formalin. Though occasionally, surgeons want an intra-operative consultation on the tissue being removed because they require pathologic information more rapidly (known as frozen section) which helps in deciding the treatment protocol. The examination is made while the patient is on the operating table. This entails a gross examination and if the specimen is larger, serial sectioning is performed. Tissues must be hardened in order to be cut into thin slices with a thickness of less than 1 cell for microscopic analysis. Tissue can be quickly hardened to the point that thin sectioning is possible by freezing. The operating surgeon is then informed as soon as possible of the frozen section report through telephone or intercoms because the outcome will significantly affect the surgeon's intra-operative decision. The pathologist is under time constraint to make the right choice based on his expertise, judgement, and understanding of clinical medicine as well as staining issues.

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Louis B. Wilson published a frozen section technique in 1905 that takes only a few minutes to complete.[4] When compared to contemporary methods like using the cryostat, the method developed by Hazard and Stevenson in 1949 is remarkable. In this method, the fresh specimen was immersed in a fixative ten times its volume and heated to just below the boiling point. The fixed block was then cut at 10-15 um with a microtome after being frozen between pieces of dry ice. Transferring each section to a beaker of distilled water. A glass rod was then used to transfer the section into a beaker that contained a solution of carbol fuschin and toluidine blue. The section was mounted onto a clean glass slide and promptly covered with cover slip after being repeatedly washed in a series of beakers filled with distilled water.

In 1957, Teloh HA essentially perfected the method by placing the unfixed specimen directly onto the microtome's freezing stage, exposing the tissue to intermittent carbon dioxide gas that caused rapid freezing, and then cutting the tissue at 25 um and staining it with a drop of aqueous thionin solution. Teloh recommended staining the permanent section with haematoxylin and eosin (H&E) method.

Particularly with the development of the cryostat in 1959, this practise has developed.[5] Hence, this development places the pathologist back on the operating room team where he originated.[6]

Tissues must be toughened before being cut into thin sections of less than one cell thickness for microscopic analysis. To quickly harden the tissue to the point where thin sectioning is possible, freezing the tissue is a rapid method. To perform a frozen section, we must choose the proper tissue, and to accomplish that, we must follow the steps listed below. To choose the tissue most likely to produce the most beneficial diagnosis, a thorough gross inspection is needed. When orientation is crucial, it should be maintained. For example, in skin-covered tissues, sections should be perpendicular to the epidermal surface and in cases of colon, sections should be perpendicular to the mucosal surface. To freeze effectively, sections should ideally be no

larger than 8 mm by 8 mm by 1-2 mm (thick). If the tissue is wet, gently blot it to remove the moisture. Tissue alterations due to freezing are irreversible. Since larger crystals develop over time, tissue should be frozen as soon as possible to reduce crystal size. Cellular structures are disturbed by ice crystals, and thawing only partially reverses these changes. Nuclei's chromatin pattern is frequently incomprehensible. Comparing frozen tissue to unfrozen tissue, nuclei can sometimes seem to be hyperchromatic. Freezing can affect the properties of an antigen, altering the immunoreactivity patterns. It is not recommended to use previously frozen tissue for further research. Results should only be utilised with caution while interpreting them. For these reasons, it is seldom advisable to totally freeze small primary tumour tissues.[7]

Type of Tissue:

Any tissue that can be cut using a scalpel or microtome can be sliced for a frozen section. Adipose tissue demands colder temperatures and is challenging to cut. Bone and other calcified lesions cannot be cut. Scrape preparations from bone may be utilised to check marrow margins on bones. Heavily calcified lesions are typically benign and do not require evaluation by frozen section intraoperatively. Fatty tissue that is not necessary for diagnosis should be removed from specimen's critical locations. It could be conceivable to cut a central section that hasn't yet been exposed to formalin if it's large enough and has only been briefly submerged in formalin. Special coated slides must be used if it is necessary to examine fixed tissue. The tissue with a suspected or known infectious condition should not be frozen unless it is absolutely necessary for patient management. The infectious diseases like HIV, hepatitis B, hepatitis C and tuberculosis pose a high risk to technical staff. When feasible, cytologic preparations should be employed in these cases. Cryostat should be labelled as contaminated and decontaminated after use if frozen sections of such cases are prepared.[8]

Terminology:

Chuck: It is the metal platform that is used for holding the embedding medium and tissue for sectioning.

Base: It is the embedding medium that is placed and frozen on the chuck to cushion and protect the tissue to be frozen.

Block: It is the tissue that is frozen on the base and covered by additional embedding medium.

Preparation of Block:

Embedding medium is a liquid mixture that hardens when frozen at the right temperature for cutting sections. There are various ways to prepare a base of embedding medium depending on the specific cryostat and the equipment utilised.

Tissue can be transferred to a frozen base by simply touching the base to the tissue. If the specimen is very small, the base can be precut and faced on a cryostat in order to limit the amount of tissue that is lost to level the block. The orientation of the margin sections is very crucial. Perpendicular margin sections should be placed so that the inked margin is clearly visible at one edge. It is important to keep track of the orientation of the en face margins, that is if the true margin of the tissue is the superficial aspect, then the first slide of the frozen section is the true margin. The labels on the slides should indicate the first level as well as any additional deeper levels if taken. When the true margin is embedded with the face down, the first frozen section will not be the true margin and if the result is positive, deeper levels that are closer to the true margin are to be acquired. Tissue should not extend beyond the edge of the chuck. Thin portions can be rolled and placed in cross sections. If multiple fragments are sent for frozen section they should be placed closely, but should not overlap each other.[6]

Freezing Tissue:

Embedding medium is applied to completely cover the tissue but it should not extend beyond chuck. If the medium extends to back or to the stem of the chuck, it must be removed or it will interfere when attaching the chuck to the cryostat. It can be kept in refrigerator to cool and speed the freezing process. It should form a rim around the tissue and support in holding the tissue. The chuck with covered tissue block is placed in cryostat to freeze.

Various types of tissues are optimally cut at varying temperatures. The majority of tissues are frozen at -10 degrees Celsius to -20 degrees Celsius. Very soft tissues like brain, spleen, adrenal gland, lymph node are frozen at -7 degrees Celsius to -10 degrees Celsius. Adipose tissue is frozen at -20 degrees Celsius to -40 degrees Celsius. [6]

Sectioning on Cryostat:

The Chuck is positioned in the microtome in such a way that the blade first cuts the most solid portion of tissue and then sections the remaining tissue. The parts of the tissue that are most solid should be placed closest to the blade. It is not appropriate to begin cutting tissue by cutting adipose tissue first. Epidermal or mucosal surfaces should be placed perpendicular to blade. In order to effectively produce thin sections, the blade in question needs to be razor-sharp and free of nicks. If the blades are dull or have nicks in them, the resulting sections will have chatter artefacts and/or holes. The block is trimmed until a full section is achieved, and the bases can be pre-faced prior to inserting the specimen to limit the amount of tissue that is lost when facing the block. Large brushes or cotton swabs can be used to clean the blade after rough cuts have been made. Always make sure that the brush is moving in the same direction as the blade. In order to avoid the risk of severe laceration from the blade, one should never remove the section by hand. The section is left slightly attached to the block in order to prevent curling. Cryostats are used to maintain a cool environment for the storage of brushes. The glass slide is put in a careful manner on

the surface of the tissue section. It is necessary to label the slides with the case number and indicate whether or not they are frozen section. The staining solutions must not affect the label and tolerate them. Frozen tissue quickly thaws when placed on a slide kept at room temperature.[7]

Fixation:

As soon as the slides have been prepared, they need to be placed in methanol. Any delay leads to a significant amount of air-drying artefact, which makes interpretation more difficult**.**

Disposition of Frozen Tissue:

Any remaining tissue should be formalin-fixed and then sent in for permanent sectioning. Small frozen section remnants are wrapped in lens paper before being placed in labelled cassettes. Frozen tissue blocks can be briefly submerged in formalin to promote mild melting, after which they can be removed by hand or with a ruler. Remove any additional embedding media that is not necessary. One of the most essential quality assurance parameters is making a comparison between frozen and permanent sections. In the case where there is a conflict in interpretation, the surgeon needs to be informed, and the explanation for the difference needs to be described in the final pathology report. In western literature, the accuracy rates for frozen section have been widely documented and published.[7-13]

Trouble points in frozen section:

<u>Shatter (or Chatter) Artifact:</u>

If the block is too cold, it can be remedied by gently warming the block with the thumb or palm of your hand. As the block will cool off quickly, the section needs to be cut as soon as possible. In order to reach the level with the optimal temperature for sectioning, it is possible that a few sections are rejected. The handwheel should be locked to prevent the block from moving. Turning the handwheel should be done in a smooth motion. Tears may result from hesitating or pausing before completing a section of the frozen section. If the block is too

warm, keep it in the cryostat for a little while longer. In the situation if the Blade is tilted incorrectly, the section's edge might not transfer very well to the plate. If there is an excessive amount of embedding medium, one should chop it down to a V shape around the tissue. The point of the V is simpler to capture with a brush. We need to check the adjustment while using the plate to hold the sections. It is possible for the blade to dislodge the block from the chuck or the block to get stuck on the heat extractor and detach from the chuck. Through the use of embedding medium, the block can be reattached to the new chuck.

Very Small Specimens

It is not always easy to obtain sufficient information from a small specimen for diagnosis. When preparing frozen sections of tissue, the base can be pre-faced in a cryostat to prevent the loss of any tissue during the facing process. When the tissue has been covered with embedding medium, it can be easier to recognise if it has been dipped in eosin first. Normal staining processes are unaffected by eosin's presence. It is possible to embed tissue in a drop of embedding medium that has been placed on a chuck that has been cooled ("wet embedding"). In order to avoid damaging the tissue before it has had sufficient time to freeze, the heat extractor is held carefully on top of the embedding media.[6]

Adipose Tissue

Fatty tissue is very difficult to cut. If the diagnosis does not depend on the presence of fatty tissue, then as much of it as possible should be removed. When the block is colder than usual for frozen sections (between -20 degrees Celsius and -50 degrees Celsius), it may be easier to cut. In case other approaches are unsuccessful, thicker sections can be cut.

Air Drying Artifact

The cells look splayed out with smudgy chromatin and indistinct cell borders after staining. Therefore, immediately following the sectioning process, the slides need to be prepared.

Ice Crystals Artifacts

As a result of the creation of enormous ice crystals, the tissue either seems crushed or is perforated with holes. Before being frozen, if tissue has any excess moisture it should be removed by blotting. There is a possibility that the specimen is too huge, and as a result, it freezes slowly, resulting in the formation of massive crystals.

Tears in Section

Ruptures in the section may be caused by staples, sutures, or bone in tissue; as a result, we need to remove any hard items from the tissue. It is possible that the blade has been nicked; thus, either replace the blade or move it to an area that is unharmed.

Tissue Does Not Adhere to Slide

A charged slide should be used to examine the extremely dense and fibrous tissue or cartilage. While staining the slides, exercise extreme caution and just a little amount of agitation.[8]

SLIDE PREPARATION:

FIXATION AND STAINING OF SLIDES

In order to make an accurate diagnosis using frozen sections, it is necessary to prepare tissue sections of a high quality. If close attention to the rapid fixation and staining is kept the results will be comparable to those obtained on formalin-fixed, paraffin-embedded permanent sections in a speedy and appropriate manner.

Labeling of slides

The surgical pathology number and the sub-designation for the specific frozen section are written on the labels that are placed on the slides. It is important to name slides before using them so that specimens are

not confused with one another. Slides that have been labelled but have not been utilised should be thrown away. Use a pencil or some kind of marker that won't disintegrate after the slide is stained. The side of the slide on which the tissue will be placed on is indicated by the label. Plain glass slides are suitable for the majority of cytologic and frozen section preparations.

Coated or charged slides

During the staining process, they are utilised to assist in maintaining tissue on the slide. In certain circumstances, unstained coated slides preserved in fixative may be sent to a histology laboratory for the application of specific stains. In the event that an infectious disease is suspected, the slides can be sent off to have specific staining performed, the results of which will be available in a few hours or early the next day.[9]

Types of fixatives

Fixatives can be made from 95%Ethanol, Methanol, Acetone and combinations of these. There are many different types of fixatives that can be made. Fixing the slide as soon as possible once a part is cut is highly critical. A container of the fixative must to be kept nearby in order to facilitate instant immersion. When fixation is delayed for a longer period of time, the tissue is exposed to air and dries out, which modifies the histologic appearance by causing a loss of nuclear detail along with blurring of chromatin, also known as an artifactual expansion of cells and nuclei. For a minimum of thirty to fifty seconds slides should be placed in the fixative. Fixation over a longer period of time is not hazardous. In order to achieve the best results, the fixative should be at room temperature.[10]

Slides that have been air-dried are typically utilised for cytologic preparations. The slides need to be totally dry before use.

Stains

Hemotoxylin and eosin, toludine blue, Rapid Papanicolaou Stain, acetylcholinesterase, Oil red O, Rapid PAS-diastase, mucicarmine, and Alcian blue stains are among the numerous stains that are utilised for frozen sectioning. [11]

Coverslip

A tiny drop of mounting media is being placed on the edge of the slide near to the tissue in order to prepare for the placement of the coverslip. The cover slip is positioned at an angle at the slide's edge near to the mounting medium. The cover slip is then carefully pushed onto the slide as the mounting medium is distributed, taking care so that no bubbles are formed.

Causes of doing frozen section:

They are listed below:

*Determining whether a lesion is neoplastic or nonneoplastic and further whether it is benign or malignant is crucial for the operating surgeon since it will determine the sort of surgical technique or additional sampling that must be performed.

*To confirm the existence of a lesion or skip lesion in a suspected tissue area and to confirm the existence of a second lesion discovered incidently during surgery.

*Determining the adequacy of margins is crucial in cases with malignant tumours. If the resected margins are positive, the surgery is not thought to have been done properly.

*To establish the proof of invasion to the nerve and lymph nodes and ascertaining metastases to distant organs is another use for it.

*To identify the cause of non-cancerous lesions and to check for granulomas, fungal infection and tissue inflammation.

*In order to avoid transplanting organs to fail, it is vital to examine an organ before transplantation (<5%).[6]

Frozen section of various organs:

The frozen section technique can be utilised for various organs in the body while the patient is on the operating table and which eventually helps the surgeon in planning the further surgical procedure which is best for the patient. Therefore the various organs in which frozen section is done and there problems are discussed below.

1) Appendix

*Goal of consultation: The purpose of the consultation is to ascertain whether or not an appendiceal carcinoma or carcinoid is present; to ascertain whether or not the proximal margin is free of carcinoid and to ascertain whether or not a low grade appendiceal mucinous neoplasm (LAMN) is there or not.

*Change in Patient Management: Right hemicolectomy may be performed in case of invasive cancer. If the proximal margin is positive for LAMN or carcinoid, more extensive surgery will be required for tumor free margins.

*Clinical Setting: Appendix may be sent for intraoperative consultation in the situations that are if the patient has dilated appendix which raises the suspicion of LAMN and if incidentally there are findings of serosal nodularity in patients undergoing resections for acute appendicitis.[14]

*Gross: The outer surface of appendix is examined for exudates, mucin pools, and nodularity that are suspicious for tumor. If grossly the lesion looks suspicious for malignancy, representative section is frozen for diagnosis.

The most prevalent diagnosis in appendix are mucinous neoplasm, acute appendicitis, endometriosis, adenocarcinoma or neuroendocrine tumours.

2) Brain

*Frozen section method in case of brain tissue: Firstly, in case of brain the tissue to be frozen is perched on a small bed of embedding medium, but the medium does not cover the tissue. Secondly, the tissue is quickly frozen with a light touch of metal heat extractor or cryospray to avoid ice crystals in the tissue. Finally, the block is carefully step-sectioned to preserve the tissue while making the slides. The use of cytologic preparations that do not involve frozen sections may be desirable in certain circumstances, that are: presence of calcifications in the specimen; very small specimens; and the suspicion of an infection.

*Characteristics of the Smear: The consistency of the tissue when placed between glass slides can be very revealing regarding the nature of the lesion. Schwannomas and fibroblastic meningiomas have a hard consistency that makes them difficult to smear. Pituitary adenomas and other benign tumours that are extremely cellular and soft can be easily smeared in single cell layers. Firm, calcified, or fibrous lesions are best treated with the touch preparation method. In this procedure, the slide surface is lightly and briefly contacted (while the tissue is being held softly in forceps). After that, the slide is immediately placed in the fixative to prevent any drying artifacts. Once the staining process is complete, the slide is examined to determine how evenly the tissue was spread across the slide. Due to the possibility of heterogeneous lesions, the entire slide is thoroughly examined.

3) Lymph node

*Goal of consultation: Is to determine in people with breast cancer if macrometastatic (≥ 2 mm) cancer is present in sentinel lymph node(s) and metastases less than 2 millimetres in size might or might not be found, but they must be reported if found. It is done in patients who have been diagnosed with axillary lymphadenopathy and hence to identify the underlying cause of adenopathy.

*Change in patient management: If metastasis is found in the sentinel lymph node, additional lymph nodes may be removed. If there are no plans for additional surgery, there is no requirement for intraoperative evaluation of lymph nodes. If lymphoma or infectious disease is found, tissue can be taken for ancillary studies.[15]

*Gross: The number of nodes that are present and the number of nodes that contain metastases are utilised to assess whether or not more surgery is required. Each lymph node is meticulously and bluntly separated from the material. If a gradient of blue dye is present, the location of the metastasis is most likely at the blue-stained pole. Each node is thinly sliced at 2mm intervals. If a node is grossly suspicious for lymphoma or granulomatous disease, preservation of non-frozen tissue is helpful for ancillary studies such as flow cytometry, molecular studies, and cultures for granulomatous diseases. All of the fat should be trimmed away from the nodes. Pathology personnel are not exposed to dangerous levels of radiation when radioactive nodes are detected using standard procedures and special protective equipment is not required. Special storage or disposal of tissue or equipment is not necessary. If a new or nonstandard technique is used, levels of radiation and the resulting risk should be evaluated. Handling procedures should be approved by the institutional radiation safety office.

*Frozen Section: If there is clear evidence of metastasis, only one section that is representative needs to be frozen. It is also possible to document grossly positive lymph node involvement by using a scrape or touch preparation. If the goal is to determine whether or not breast cancer has spread, all slices of grossly normal lymph nodes are preserved in liquid nitrogen. Only one representative section should be frozen if the goal is to establish a diagnosis in order to explain lymphadenopathy. If the purpose is to establish a diagnosis in order to explain lymphadenopathy, at least one H&E slide containing a complete cross section of all the slices should be evaluated.

When an infection or lymphoma is suspected, it is helpful to have this information. It is possible that touch imprints, as opposed to scrape preparations, are more beneficial for lymphoma.

4) Ovary

*Goal of Consultation: To determine whether the ovarian lesion is benign or malignant. To evaluate the likelihood of metastasis in malignant mucinous carcinomas and compare it to the likelihood of primary carcinoma. To determine the correct staging for patients diagnosed with carcinomas like uterine carcinoma where involvement of the ovaries increases the stage of the disease. Patients who have ovarian carcinoma may have a different stage if the cancer has spread to the surface of the ovary.

*Changes in Patient Management: If cancer is detected, proper staging biopsies and final surgery may be performed like TAH and BSO, debulking of large tumors, peritoneal washings and lymph node biopies. If no malignancy is identified, no additional surgery is required. Fertility can be preserved in premenopausal women. If there is no previous history of cancer and there is a suspicion of metastasis to the ovary, an examination of the peritoneal cavity to look for probable primary sites is performed. The appendix is a potential location and may need to be removed.

*Clinical Setting: It is difficult to determine if an ovarian mass is benign or malignant prior to surgery as imaging findings are often nonspecific and needle biopsy is contraindicated due to the risk of spillage of malignant cells into the peritoneal cavity. Malignancy is more common in women over the age of 40. Ovarian lesions in women under the age of 40 are typically benign. The preservation of fertility is a common goal in young women.[16]

*Gross: When checking the outer surface of the ovary, extreme caution should be exercised because involvement of surface of ovary can change the stage. The surface should not be rubbed or abraded in any

way. Ovary is serially sectioned cysts with fluid under pressure can appear to be solid masses by palpation; these cysts should be opened with caution and with proper eye protection to avoid the uncontrolled release of contents; a small incision that is directed away from the prosector is made. It is strictly forbidden to touch the inner surface of cysts, as this could cause diagnostic cells to become dislodged. In cases of metastatic illness, it is possible to observe bilateral involvement or several nodules inside a single ovary. It is important to determine if the contents are serous (freely flowing) or mucinous (viscous and sticky). A smooth-walled unilocular cyst is nearly invariably a benign condition, and the most common diagnosis are cystadenoma, follicular cyst or luteal cyst. If a cystic lesion is found to be full of sebaceous material and hair, then a mature cystic teratoma also known as a dermoid cyst, is most likely the cause. A superficial examination is all that is necessary unless there is a significant amount of solid area or the cyst has ruptured. Rare cancers have malignant component as well. Cysts that are unilocular or multilocular may have solid or uneven regions. The lining epithelium is examined, and the inner lining must never be stroked because doing so can cause diagnostic lining epithelial cells to become dislodged. The presence of minute papillary excrescences or solid/nodular regions raises a red flag for possible malignancy or borderline tumours. A frozen portion might be taken from the area that seems the most suspicious. When a hemorrhagic mass is present, the most common diagnosis are ovarian torsion, endometrioma and nongestational choriocarcinoma; however, tumours can also sometimes cause torsion. In older women, endometriomas have a higher risk of developing into cancer. Frozen sections can be taken from solid areas that raise concerns about the presence of cancer. The vast majority of cases of solid mass are noncancerous, although a significant number of cancers have this appearance. In most cases, carcinomas have a homogenous look, although the proportions of necrosis, haemorrhage, and cystic degeneration that they contain might vary greatly. The presence of extensive necrosis is consistent with metastatic colon cancer.

*Frozen section: It may be conducted in cases with suspected borderline tumour (both mucinous and serous) or mucinous carcinoma. Frozen sections may also be performed in cases when unequivocal diagnostic features are not evident the lesion is best examined by comprehensive sampling on permanent sections.

*Reporting Frozen Section: In cases of carcinoma where the subtype (serous, mucinous, or endometrioid) is obvious, a specific diagnosis is appropriate. Cases with ambiguous histologic features or mixed phenotypes may be reported as "carcinoma" with note describing tumour grade (low vs. high) and possible subtype. If lesion is a possible metastasis, this should be reported as carcinoma with extensive necrosis. If a definitive diagnosis of cancer cannot be made, it is advisable to postpone the procedure until permanent sections can be performed. If it is determined that the patient has cancer, the patient may receive conclusive surgery during the second operation.

• Borderline tumours: When attempting to illustrate the heterogeneous nature of these tumours, the use of the word "at least" is suitable. After more extensive sampling on permanent sections, up to one quarter of cases will indicate regions of cancer in the affected tissue. Surgeon ought to be informed of the number of portions that were scrutinised.

• Solid spindle cell tumours: The presence of significant cellularity, atypia and necrosis may be indicative of malignant sarcoma. On frozen section, fibromas and leiomyomas may seem similar to one another because of this the diagnosis of benign spindle cell neoplasm is appropriate.

5) Parathyroid gland

*Goal of Consultation: The purpose of the consultation is to verify the removal of parathyroid tissue as either the complete gland or as a biopsy, as well as to verify that abnormal parathyroid glands have been eliminated.

*Change in Patient Management: After removal of parathyroid gland(s) or confirmation on biopsy, additional surgery is not necessary. Differentiation of adenoma, primary hyperplasia and normal parathyroid may be used to guide surgery. Confirmation of the presence of parathyroid cancer can guide completion of surgery in extremely rare cases.

*Gross: The specimen, which may be a biopsy or an excision of the entire gland, is described while grossing as a gland that is ovoid in shape, the whole gland is surrounded by a capsule that is glossy and smooth (size and shape of kidney bean). Size and weight are taken into account. Adenoma is single enlarged gland with a rim of normal tissue which may be identifiable on cut section. Multiple enlargements of glands are referred to as hyperplasia. A biopsy is done of a small portion of tissue that has an uneven shape. Inking is not indicated unless there is a clinical or gross suspicion of cancer. Carcinomas are often big (more than 2 centimetres). Additional adhering tissue may be removed by the surgeon. Complete glands are sectioned in a sequential fashion. Frozen Section and representative section of entire gland is frozen. The biopsies are frozen completely for analysis.

*Special stains: Oil red O is used which stains the parenchymal cells in normal glands that have a substantial quantity of intracytoplasmic lipid droplets. This stain is used to highlight these droplets. In hyperfunctioning parathyroid cells, the amount of intracellular and extracellular parenchymal lipid content is reduced to the point where it is absent. This stain is able to reveal the rim of normocellular parathyroid, which serves as conclusive evidence that a parathyroid adenoma is present.

*Reporting of Frozen Sections: We are required to provide evidence that parathyroid tissue is present and if the entire gland was removed, its size and weight must be reported. We have to report if at least one gland or glands are hypercellular and hence report the percentage of adipose tissue that was present. It is not essential to make a specific

diagnosis of adenoma or hyperplasia, because doing so is frequently not possible. It is possible to arrive at a diagnosis of adenoma if a single gland is enlarged and there is a rim of normocellular parathyroid. When using oil red O stain, it is important to note whether or not intracellular and extracellular lipid is present and to record its presence or absence.[17]

6) Skin

*Goal of Consultation: The most typical reason for having an intraoperative consultation (IOC) in skin is to confirm that a malignant skin tumour has been entirely removed. An IOC is only occasionally utilised to determine the primary diagnosis of a tumour.

*Change in Patient Management: Additional skin will be removed around the tumour in order to obtain clear margins if the diagnosis was initially positive.

*Clinical Setting: Skin tumours are typically diagnosed when a shave, punch, or small excisional biopsy is done. The majority of carcinomas that are submitted for IOC are either basal cell carcinoma (BCC) or squamous cell carcinoma (SCC). Rarely, FS's may be performed on Merkel cell carcinoma or adnexal carcinomas. Completely freezing small lesions for primary diagnosis is not recommended. Minimal margins may be taken to optimise cosmetic results. It is sometimes difficult to differentiate melanoma in situ from melanocytic hyperplasia in sun-damaged skin. FS diagnosis of melanoma, has low sensitivity and specificity because of frozen section artefacts and sampling error. The diagnosis should be based on well-fixed and orientated permanent sections.

*Gross: It's possible that shave biopsies and punch biopsies are quite infrequent. The size of the specimen, the depth of the excision, and the colour of the skin and borders (circumscribed or irregular) of all lesions need to be documented. The distance of the lesion or lesions from the margins should also be written. The location of the initial

lesion may be obscured as a result of a previous biopsy. A diagram indicating the orientation of the sutures, the ink colours and the position of the FS is beneficial. The specimen is sectioned in a sequential order.

*Frozen Section: The frozen section consists of a section of skin that has closest perpendicular margin(s) and deep margin.

*Reporting of Frozen section: The presence or absence of a tumour, confirmation and identification of the type of tumour that is present is done. It is possible that FS cannot provide a definitive type for the tumour (i.e., poorly differentiated and sarcomatoid carcinomas). The current status of the margin that is whether it is positive or negative needs to be documented. Perineural invasion, if present needs to be mentioned in the report.[18]

7) Ureter margins

*Goal of Consultation: Determine whether or not the ureteral margins of the cystectomy specimen are free of urothelial carcinoma in situ and invasive carcinoma.

*Clinical Settings: Cystectomies are typically performed for muscle invasive urothelial carcinomas (pT2) and therapy refractory urothelial carcinomas in situ in a clinical setting.

*Gross: True margin should be identified if specimen is too long to be entirely frozen en face. It is often identified by the presence of stitch or clip at one end of ureter segment. Small length of ureter is usually provided.

*Frozen Section: A cross section of the margin is embedded with the true margin facing up in order to ensure that the first frozen section will be of the true margin. If it is not possible to see a complete urothelial cross section on the initial sections, one should proceed to reach

deeper levels. If there is significant denudation of the urothelium we should get additional levels.

*Reporting Frozen Section: We should report as positive for carcinoma in situ and/or invasive carcinoma or negative for malignancy. If atypical cells are present; surgeon may choose to send additional margins if features are worrisome, to avoid carcinoma recurrence within the remaining upper urinary tract.[19]

8) Pancreatic margins

The most common entity to be reported in pancreas is intraductal papillary mucinous neoplasm. Therefore the grading system for the same is summarised below.

DYSPLASIA	ARCHITECTURE	NUCLIE	CYTOPLASM
Low grade (mild dysplasia)	Mild intraluminal papillary proliferation noted.	They are small, basal and ovoid.	It has a gastric phenotype.
Intermediate grade (moderate dysplasia)	Florid intraluminal papillary proliferation seen	They may be pencillate, hyperchromatic or stratified.	Intestinal (goblet cell) phenotype may be seen.
High grade(Severe dysplasia)	Florid intraluminal papillary proliferation with solid/cribriform areas noted.	Marked pleomorphism with prominent nucleoli noted.	High nuclear:cytoplasmic ratio, no specific line of differentiation noted.

9) Peritoneal/Omental biopsy

*Goal of Consultation: It is to identify the mass within peritoneum: whether it is benign or malignant.

*Change in Patient Management: Surgery that was planned may be changed if malignancy is found and if the existence of malignancy was unexpected, a search for the primary site may be performed. When malignancy is already known to be present, the presence of metastatic disease may change the sort of surgery that was planned. Women who have ovarian lesions may have samples taken from their peritoneum or omentum to determine if an invasive implant is present. If an invasive implant is discovered, the surgeon may decide to install a port for chemotherapy.

*Clinical setting: Abdominal cavity exploration is frequently performed by the surgeon during abdominal surgery to treat benign or malignant diseases. In order to properly direct the surgical procedures, it is critical to ascertain the nature of any masses that may have been discovered whether they are benign or malignant.

*Gross: In patients with ovarian masses, the omentum may be removed and sent for intraoperative consultation to assess the presence and types of implants. In general, the mass does not need to be inked because primary isolated peritoneal malignancies are extremely rare. Tissue is serially sectioned. The focal lesions are identified and then their size, number, colour and borders of lesions are mentioned.

*Frozen Section Reporting: We completely freeze the small biopsies. Areas of fleshy tumor growth are preferentially sampled in large samples. Areas of extensive necrosis or mucin should not be sampled as they are often nondiagnostic. Diffusely infiltrative carcinomas in omentum may appear slightly paler and firmer than the normal adipose tissue. Frozen section evaluation of grossly normal specimen is of low yield and is generally contraindicated.[20]

*Most common diagnoses in Omentum are as follows:

Metastatic Carcinoma (Nonovarian): If patient has history of malignancy, or known current malignancy, it is vital to determine histologic type and whether or not patient has been treated. Tumors of gastrointestinal system often show metastasis to peritoneum and have diversity of histologic appearances. Colon cancer is typically composed of glands with varying degrees of dilation and tall columnar tumour cells line these glands with extensive areas of central necrosis. Pancreatic carcinomas are often metastatic at time of surgery which is detected by presence of mucinous glands, desmoplasia, and perineural invasion which are helpful features in identifying this tumour. Surgery for curative intent is often aborted if metastatic disease is identified. Signet ring cell gastric carcinoma may metastasize widely and these are identified by the presence of small tumour cells with little cytoplasmic mucin which may resemble histiocytes or lymphocytes and it can be difficult to identify. Enlarged cells with numerous mucin vacuoles that displace nuclei are simpler to spot.

Lobular carcinoma of breast may have strikingly similar look and should be included in differential diagnosis if primary is unclear. These carcinomas are often not associated with desmoplastic response. Infiltration into the adipose tissue may be slightly paler and stiffer than normal tissue. Tumor cells can imitate reactive mesothelial cells

Pseudomyxoma peritonei is typically secondary to appendiceal primary. The specimen is predominantly made up of mucin, with just a few scattered foci of mucinous epithelium that may or may not be present on frozen section.

Neuroendocrine tumours are typically composed of nests, cords, or trabeculae of tumour cells all of which display vesicular (also known as "salt and pepper") chromatin. Cancers that originate in locations other

than the abdomen can also metastasize to the abdomen, but this occurrence is much less common.

Ovarian Carcinoma: In women with ovarian masses, serous tumours (borderline, low grade, and high grade) are most likely to be associated with metastasis. High-grade carcinomas frequently demonstrate dramatic nuclear atypia, enhanced mitotic activity, and extensive dissemination. Low-grade carcinomas sometimes display catastrophic invasion of underlying structures but are cytologically bland compared to their high-grade counterparts. Extraovarian implants may be placed in women undergoing surgery who have tumours that have a low risk of developing into cancer (borderline tumours). Type of implant is a crucial prognostic factor.

Non invasive implant (borderline tumor): Desmoplastic reaction is associated with a prominent stromal reaction and characterised by the formation of smoothly contoured foci of glands that are encircled by fibrous stroma. Papillae and glandular structures can be present in epithelial lesions. Epithelial lesions are not accompanied with a pronounced stromal reaction.

Invasive implant (low-grade serous carcinoma): It demonstrates definite, irregular, and destructive invasion along with desmoplasia into normal underlying tissue structures. If invasive implant is distinctively identified on the frozen section, the surgeon may choose to place a catheter for chemotherapy at the time of surgery.

Mesothelial lesions: Mesothelial hyperplasia: Reactive mesothelial hyperplasia is a reasonably common observation and it is commonly accompanied by an instigating source of irritation, such as peritonitis or endometriosis. According to the definition, there is no evidence of penetration into the underlying tissue. It is possible to observe a wide variety of patterns, such as tufts, papillae, spindle cells, tubules, solid nests or single cells. In general, mesothelial cells have very few instances of nuclear atypia. There are either none or very few mitoses

and typically include abundant of cytoplasm. It is possible for necrosis to be present in low-grade (well-differentiated) mesothelioma. This type of mesothelioma might manifest as cystic or papillary masses. They are more prevalent in females and are typically discovered during surgical procedures as a serendipitous finding. Typically they are smaller than two centimetres in length (although rare lesions are diffuse). Mitotic figures are infrequent or nonexistent. There is no evidence of an invasion. On frozen section, it may be impossible to differentiate reactive and low-grade mesothelial lesions; therefore, extensive sampling for permanent sections should be performed. Malignant mesothelioma can present with a wide variety of histologic patterns, including papillary, tubulopapillary, solid, sarcomatoid, and epithelioid. Invasion, necrosis, increased mitotic activity, and nuclear atypia are all signs that a malignant tumour has developed. Tumors are typically large and extensive. However, some places may have the appearance of a low-grade tumour and may even resemble a well-differentiated or reactive growth.

Adenomatoid tumor: A benign growth of mesothelial cells that is adenomatoid tumours can develop in the subserosa of the uterus and in the fallopian tube, in addition to the testis and epididymis. Extragenital areas, such as the mesentery or omentum, may be extremely rare. They are hard, tan-gray nodules that are often quite small but can grow to be as large as three centimetres in diameter. The presence of lymphocytic infiltrates or germinal centres is frequently observed. Cells can form cords or tubular spaces in a structure. It is possible for this to be present in dense stroma or smooth muscle. The epithelium of the cells is low cuboidal, and the cell boundaries are visible. Vacuoles can mimic mucin vacuoles. Nuclear atypia should be kept to a minimum, and mitoses should be uncommon.

Peritoneal Inclusion Cyst: Cysts most commonly affect females between the ages of 15 and 45 years old. It can be a single instance or several instances. Cysts are normally unilocular and have thin walls,

are lined by a single layer of bland mesothelial cells and are filled with clear fluid. Cysts can however be filled with a variety of fluids. Incidental observations of small cysts are very typical. Large cysts have the potential to cause symptoms, and some of them are multilocular.

Endometriosis: It is characterised by the gross formation of masses that range in colour from red to black and affects only women of reproductive age (has appearance of powder burns). Adhesions are a potential result of both bleeding and inflammation. Definitive diagnosis requires 3 components: Endometrial glands which are characterised by their tall columnar cells that are arranged in a single layer. Endometrial-type stroma which is characterised by its short spindle cells that are capable of being decidualized. Macrophages that are loaded with hemosiderin as a result of bleeding.

Endosalpingiosis: It is a condition that only affects females and is almost often discovered by accident. On the peritoneum, it manifests as solid nodules or cysts that might be white or yellow. It consists of small, dispersed, simple glands bordered by tubal type epithelium and may also be found in lymph nodes. Sometimes, larger cysts, simple intraluminal papillae, or cellular stratification may be present. These structures are bordered by secretory-type cells, peg cells, and ciliated cells. In some cases, cellular stratification may be present.

Endocervicosis: It is a benign endocervical type glands that can be detected in the cul-de-sac and posterior uterine serosa of women who have endocervicosis. Mucinous glands have nuclei that are basally orientated and have abundant of eosinophilic cytoplasm

Gliomatosis: It is characterised by the presence of mature glial tissue on the surfaces of the peritoneum. Ectopic tissue is indistinguishable from mature glial tissue found in the central nervous system, as it possesses the same characteristics, such as small round nuclei and

rich eosinophilic fibrillary cytoplasm. It may be associated with ovarian teratoma but does not influence prognosis.

Splenosis: It is commonly connected with prior abdominal injuries. Splenosis can manifest as a single accessory spleen or as dispersed nodules that range in colour from red to brown. Histologically it is equivalent to splenic parenchyma.

Peritoneal Leiomyomatosis: It may be primary or subsequent to morcellation of uterine leiomyomas. This condition only affects females. It is having a histological appearance comparable to uterine leiomyomas. It is made up of cells that are unremarkable and spindled, and their nuclei are shaped like cigars. These cells are grouped in fascicles that intersect with one another. Mesonephric remnants can be found close to the fallopian tube. These remnants take the form of scattered glandular structures that are surrounded by small bundles of smooth muscle and lined by low cuboidal epithelium. Eosinophilic secretions may be present in the glandular lumina of these remnants. Pancreatic tissue that has been displaced can be seen in the wall of the small intestine. Urachal remnants can be found in the dome of the urine bladder.

Fat Necrosis: It may manifest as confined or irregular hard mass that may be calcified.

Granulomatous Peritonitis: Granulomas can be discovered in the peritoneum for a variety of different reasons like keratin, infections such as mycobacterium tuberculosis or fungi like actinomycetes. It can also be seen against foreign material such as barium or plant material which can be distributed into peritoneum following intestinal perforation. If there is a known primary malignancy the specimen can be confidently diagnosed as a metastasis if the histologic features of the main tumour and the peritoneal tumour are identical. Lesions of indeterminate malignancy that is in cases of unknown malignant potential, the phrase "at least" should be utilised. This means that it should be reported as

"at least reactive mesothelial hyperplasia, low-grade mesothelioma cannot be completely excluded, final diagnosis deferred to permanent sections if the lesion is not definitely benign. If the case is of unknown primary that is in cases in which a primary neoplasm is undefined, reporting "adenocarcinoma, not otherwise specified" is appropriate. If the characteristics of an invasion are not conclusive, it is the best way to classify until permanent areas are examined and communicate the least amount of potential damage.

A retrospective analysis done by **Shretha S et al** in year 2009 of 404 frozen sections on various tissue specimens showed an accuracy of 94.6% with false positive rate of 1.5% and false negative rate of 3.9% . 3.9% cases were deferred of diagnosis. They divided the diagnostic errors related to intraoperative consultation into interpretation error (57%), sampling errors (35%) and lack of interdepartmental communication (8%). The causes of false positive diagnosis were due to interpretation error which occurred due to artifacts from freezing procedure and rarity of the lesion. Sampling error was the reason for false negative diagnosis. In 3.9% of cases, diagnosis was deferred to permanent sections mainly due to lack of adequate clinical information and inadequate material. The most common indication of frozen section encountered was verification of type of neoplasm (360/404), assessment of margins (120/404) and for nodal status (93/404).[14]

Study by **Patil P et al** done in the year 2015 of 100 frozen section cases showed an accuracy of 96.96% with false positive and false negative rates of 1.01% and 2.02% respectively and 01% case was deferred for permanent paraffin sections. The deferred case specimen was from pancreas and it was deferred due to inadequate material. Sensitivity, specificity, PPV and NPV were 97.22%, 96.03%, 98.59% and 92.86% respectively. The most common indications for frozen section was observed to be primary diagnosis (55%), assessment of margins of tumour excision (34%) and assessment of nodal status (11%) mostly in breast and oral malignancies.[15]

Study by **Hatami H et al** done in the year 2015 of 306 frozen section specimens of which 289 cases (97.96%) were concordant to the permanent diagnosis and 6 cases (2.03%) were discordant. 2 cases out of 6 discordant cases were due to sampling error and 4 cases were due to interpretation errors. Specimens were primarily from the head and neck, thyroid, ovary, parathyroid and lymph nodes. The sensitivity, specificity, PPV, NPV were 92.95%, 99.55%, 98.50%, 97.80% respectively and 3.59% cases were deferred diagnosis.[16]

Study by **Mishra S et al** done in the year 2016 of 67 frozen section specimens showed an accuracy of 96.2%. 2 cases were discordant with false negative diagnosis in which the specimens from gall bladder and thyroid were received. The primary indication was presence/typing of neoplasm in 44 cases, clearance of margins in 7 cases and to determine presence of ganglion cells in one case of hirschsprung disease. The discrepancy was attributed to interpretation error (1.92%) and sampling error (1.92%).[17]

Study by **Barvoh A et al** done in the year 2018 of 84 frozen section showed an accuracy of 95.81%. Sensitivity, specificity, PPV, NPV were 92.7%, 98.8%, 98.7%, 93.2% respectively. The common indications for frozen section in this study was confirmation of primary diagnosis-benign/malignant (87%), surgical margin involvement (4%) and assessing nodal status and skin involvement in malignancies (9%). Out of 84 cases 91.6% cases were concordant and 8.4% cases were discordant. The maximum discordant cases were in neuropathological specimens. The reasons for discordance was sampling error and interpretation error.[18]

Study by **Phulgirkar PP et al** done in the year 2018 of 75 frozen section showed an accuracy of 90.7%, with false negative rate of 4% and 5.3% cases of inconsistent diagnosis which was due to lack of adequate clinical information and material. The common limitation experienced was freezing artifacts. The primary indication of frozen section was observed to be presence /typing of neoplasm.[19]

Study by **Santana RP et al** done in the year 2018 of 1226 frozen section cases showed an accuracy rate of 96.3%. 1181 cases (96.33%) were concordant and 45 cases(3.67%) were discordant. The tissue that had most false positive results was mammary sentinel lymph node. The reasons for discrepancy were sampling error, misunderstanding and complexity of the diagnosis.[20]

Study by **Shah HS et al** done in year 2019 of 264 frozen section cases showed an accuracy rate of 97.3%. Seven cases were discordant (2.7%) with three cases reported as false negative (1.1%) and four cases as false positive (1.5%). The most common indications of frozen section was adequacy of margins and presence /typing of neoplasm.[21]

Study by **Tangde A et al** done in year 2019 of 83 patients, of which 73 were female and 10 were male. Out of 83 cases, the diagnosis of 76 cases was concordant with conventional histopathology diagnosis while seven were discordant. This gave overall accuracy rate of 91.57% and discordant rate of 8.43%. The overall sensitivity was 85.71% and specificity was 97.92%. The positive predictive value and negative predictive value was 96.77% and 90.38% respectively.[22]

Study by **Krithiga M et al** in year 2019 of 30 cases the histopathological section diagnosis of all 30 ovarian specimens revealed 66.66% benign tumours and 33.34%malignant tumours. The final frozen section revealed 60% benign tumours and 40% malignant tumours. The overall accuracy rate of frozen section analysis was 93.33%. However the failure rate was 6.67%. The 6.67% negative results could have occurred due to any sampling errors.[23]

Study by **Tamhane AN et al** in year 2020 of 103 patients, 51 (49.51%) were oral squamous cell carcinoma, 35 (33.98%) carcinoma breast, 9 (8.74%) carcinoma colon, 4 (3.88%) squamous cell carcinoma of skin, 3 (2.91%) basal cell carcinoma, and 1 (0.97%) malignant peripheral nerve sheath tumor. Frozen section diagnosis for margin clearance of the above organs showed that the sensitivity, specificity, positive

predictive value (PPV), negative predictive value (NPV), and accuracy were found to be 100%, 98.71%, 100%, 100%, and 99.02%, respectively. The sensitivity, specificity, PPV, NPV, and accuracy of TIC for surgical margin clearance were 46.15%, 100%, 100%, 84.62%, and 86.40%, respectively.[24]

Study by **Eichinger SE et al** done in year 2022 in which sixty-five orbital surgeries were performed with a total of 89 frozen sections sampled. In 63 surgeries (96.9%), at least 1 frozen section diagnosis matched the final permanent section diagnosis. Overall, frozen section diagnosis corresponded with permanent section diagnosis in 81 of 89 (91.0%) specimens. Of the 8 (9.0%) specimens from 5 unique patients that did not correlate, the final diagnoses on permanent sections were amyloidosis (5), margin-positive infiltrating breast carcinoma (2), and lymphoid hyperplasia (1). The discrepancy between frozen and permanent sections did not alter care in any patient.[25]

Study by **Dhandapani K et al** in year 2022 in which a total of 281 cases were evaluated. 88 cases were positive on FS while 92 cases were positive in permanent sections (one falsepositive and five false-negatives) with sensitivity, specificity and accuracy of 94.57%, 99.47% and 97.86% respectively. SLN positivity was significantly less in T1 tumors (17.7%; p-0.005), grade I tumors (17%; p-0.040) and in triple negative tumors (15%; p-0.041). In SLN positive cases, T1 tumors showed lesser additional ALN positivity (11.11%) comparing higher T stage tumors (35.71%). FS of SLNs in breast carcinoma has high sensitivity and accuracy.[26]

Diagnostic discrepancies between frozen and permanent section are commonly observed in tissue from skin, breast, uterine cervix and thyroid.[27-31]

MATERIALS AND METHODS

Source of Data

All the frozen section tissues of all the organs received in the Department of Pathology in Dayanand Medical College and Hospital, Ludhiana over a period of 1 year prospectively (1st March 2021- 28th February 2022) were assessed and compared with histological sections.

METHOD OF COLLECTION OF DATA

INCLUSION CRITERIA

All frozen sections received in the pathology department

EXCLUSION CRITERIA

All the histopathological specimen for which frozen section was not sent.

FROZEN SECTION PROCESSING

The principle of cutting frozen sections is simple that is when the tissue is frozen, the interstitial water in the tissue turns to ice and in this state the tissue is firm, the ice acts as the embedding medium. For frozen sectioning the following steps were followed:

- Embedding media like TBS or Cryogel was placed on an appropriate sized chuck that was precooled in the cryostat
- The chuck was placed into a -20 to -15 degree (optimal) cryostat
- The tissue was placed on the semisolid chuck and more media was added rapidly over the tissue, covering it entirely but avoiding overflow
- The chuck was quickly placed back into the cryostat
- "Quick freeze" option on cryostat was used.
- Once the chuck was is in position, then manually the block was moved close to the cutting blade.

- The tissue was fully seen by using a trim setting on our cryostat; then an advance button was pressed each time before one full revolution of the instrument's wheel was followed.
- As the tissue was cut, the tissue was anchored to prevent folding or curling; this was done by using a precooled paintbrush with stiff bristles and a wide gripping surface
- The brush was held like a pen with our left hand.
- The fifth finger was rested on the stage for stabilization
- The wheel was turned with right hand in a continuous motion without stopping.

RAPID HEMOTOXYLIN AND EOSIN STAINING:

- After obtaining frozen section, the slides were immediately fixed in 95% ethanol
- The slide was then dipped in 95% alcohol for 45 - 60 seconds followed by water for 5 - 7 seconds
- Then the slide was stained with haematoxylin for 60 seconds
- The slide was then washed with water and stained with eosin for 20 - 60 seconds
- The slide was then dipped in 95% alcohol for 10 seconds followed by 100% alcohol for 10 seconds
- The slide was then dipped in Xylene for 10 seconds
- Then mounting media was added for cover slipping

TOLUDINE BLUE STAINING:

- The slide was dipped in 95% of alcohol and then stained with toludine blue for 1-2 minutes.
- Then the slide was washed in distilled water 3 times.
- The slide then underwent dehydration quickly by the use of 95% alcohol and then 2 changes in100% alcohol.
- Then the slide was cleared in xylene solution 2 times.
- The slide was then covered by coverslip with resinous mounting medium.

PARAFFIN BLOCK TISSUE PROCESSING:

The tissue fixed in 10 % formalin was processed through a series of solutions in the automatic tissue processor as follows:

- Acid formalin for 4 hours
- Formal alcohol for 1 hour
- 80% ethyl alcohol for 1 hour
- 90% ethyl alcohol for 1 hour
- Absolute ethyl alcohol for 1 hour
- Acetone [1st change] for 1 hour
- Acetone [2nd change] for 1 hour
- Xylene [1st change] for 1 hour
- Xylene [2nd change] for 1 hour
- Paraffin [1st change at 58-69°C] for 1 hour
- Paraffin [2nd change at 58-69°C] for 1 hour

The paraffin embedded tissue blocks were cut at 2-3um thickness by rotary microtome. The sections were then transferred onto aluminized slides. These sections were labelled properly with the help of glass marking pencil.

HEMATOXYLIN AND EOSIN STAINING OF PARAFFIN BLOCK TISSUE:

- Slides were kept on hot plate in order to dewax the sections at temperature upto 60ºC.
- Then the slides were deparaffinised in xylene
- Then hydration was done by passing through descending rates of alcohol to water
- The slides were then stained in harris haematoxylin for 15 minutes.
- Sections were washed well in running tap water until sections turned blue.

- These sections were then differentiated in 1 % acid alcohol [1% HCL in 70% alcohol] for 5-10 seconds, washed well in tap water till sections were again blue for 5 minutes or less.
- These were again stained in 1% eosin for 10 minutes followed by washing in running tap water for 1-5 minutes.
- Sections were dehydrated once again through ascending grades of alcohol, cleaned in xylene and mounted with DPX [Distyrenedibutylphtalate xylene] avoiding the air bubbles.
- Stained slides were then subjected to microscopic examinations under both low power [10X] and high power [40X]

STATISTICAL ANALYSIS

Data was described in terms of range; mean ±standard deviation (± SD), frequencies (number of cases) and relative frequencies (percentages) as appropriate. Sensitivity, specificity, accuracy, positive predictive value, and negative predictive value were calculated. All statistical calculations will be done using (Statistical Package for the Social Science) SPSS 21version (SPSS Inc., Chicago, IL, USA) statistical program for Microsoft Windows.

OBSERVATIONS AND RESULTS

This study was conducted in the Department of Pathology at Dayanand Medical College and Hospital, Ludhiana over a period of 1 year prospectively from 1st March 2021- 28th February 2022. All the fresh tissue specimens sent for frozen section examination with a specific indication were examined grossly and sections from the representative areas were processed. Frozen sectioning was done on cryostat and it was set at a temperature range depending upon the nature of the tissue. Sections were cut at a thickness of 4-6 micron and were immediately stained with rapid Haemotoxylin and Eosin (H&E) stain and Toludine blue stain. Sections were examined simultaneously on Decahead microscope by everyone available in the department. Frozen section diagnosis was immediately conveyed to the operating surgeon. The time of receiving the specimen in the department and the time at which the frozen section report was informed to the surgeon was noted for every case as it was a critical parameter.

Subsequently, the rest of the specimen was fixed in 10% of formalin which was then grossed and adequate representative sections were processed. The sections were then stained with haemotoxylin and eosin (H&E) stain. The frozen section diagnosis was compared to final histopathological diagnosis of paraffin fixed sections and a detailed analysis was done.

In our study period we received a total of 183 frozen section in our department which were analysed.

Age distribution of patients

The commonest age group who underwent frozen section were between 41 to 50 years comprising of 52 cases [28.5%] followed by 48 cases [26.2%] who were in the age group of 51 to 60 years. The youngest patient was 13 years old while the eldest patient was 78 years old. Mean age was 53.4 years.

Table 1-Age wise distribution [n=183]

Age group(years)	No.of cases	Percentage
11-20	1	0.5%
21-30	6	3.2%
31-40	18	9.9%
41-50	52	28.5%
51-60	48	26.2%
61-70	45	24.6%
71-80	13	7.1%
Mean	53.4	
Range	13-78	

Gender Distribution of patients

Overall frozen section was performed more for females constituting 146 cases [79.8%] of the patients with a male to female ratio of 1:3.9

Table 2- Gender wise distribution [n=183]

Sex	No.of Cases	Percentage
Females	146	79.8%
Males	37	20.2%

Indications of Frozen Section

Frozen section was ordered in 85 cases [46.5%] for primary diagnosis, while in 64 cases [34.9%] it was done to look for metastasis and the remaining 34 cases [18.6%] were sent to assess the resected margin status. The term primary diagnosis means to ascertain the nature of a lesion; whether neoplastic or nonneoplastic. If neoplastic then whether it is benign or malignant. Requisition was also sent to ascertain the resected margins status in malignant tumors. Another common indication for frozen section was to look for metastasis in various organs like lymph nodes, omentum and peritoneal biopsies.

Table 3 – Indications of Frozen Section [n=183]

Indications	No.of Cases	Percentage
Primary diagnosis	85	46.5%
To rule out metastasis	64	34.9%
Status of resected margins	34	18.6%

Type of specimen received for frozen section

Out of the total 183 specimens, 136 [74.3%] were small specimens while 47 specimens [25.7%] were large. Small specimens included any specimen of size less then 5 cm which included endometrial currettings, resected margins, sentinel lymph nodes and suspected nodules of metastatic deposit. The large specimen included resection specimens like hysterectomies, cholecystectomies, appendicectomies, ovarian masses, thyroidectomies, parathyroidectomies and a segment of intestine.

Table 4-Type of specimen received for frozen section [n=183]

Type of specimen	No.of cases	Percentage
Small specimen	136	74.3%
Large resection specimen	47	25.7%

Time taken for evaluation of frozen section

This was a critical parameter in our study as our department is housed in the same building as the operation theatres. So the revert time was calculated from the time the specimen was received in our department to the time the report of frozen section was informed to the operating surgeon. In 78 cases [42.6%] the revert time was 21-30 minutes while in majority of cases that is in 91 cases [49.9%] the revert time was 31-40 minutes. Mean time taken was 36.3 minutes. Least amount of time taken was 26 minutes. Maximum time taken was 55 minutes in 2 cases. In these 2 cases frozen section was done to ascertain the

primary diagnosis of malignancy for which we had received a hysterectomy specimen and a large ovarian mass where we had put multiple sections for the diagnosis.

Table 5: Time taken for evaluation of Frozen section (n=183)

Time taken [minutes]	No. of cases	Percentage
21-30	78	42.6%
31-40	91	49.9%
41-50	12	6.5%
51-60	2	1.0%
Mean	36.3	

Frozen section diagnosis

All the cases were categorized as neoplastic and non- neoplastic.

In one case the diagnosis was deferred.

Non neoplastic-This category comprised of inflammatory, infective lesions like granulomatous inflammation including tuberculosis, sarcoidosis, acute suppurative pathology and reactive lesions like reactive hyperplasia of the lymph node along with endometriosis.

Neoplastic**–**This group included cases which were either benign neoplasms, suspicious for malignancy or malignant neoplasm.

Table 6 : Frozen section report [n=183]

Frozen section report	No. of Cases	Percentage
Non-neoplastic	111	60.7%
Neoplastic	71	38.8%
Deferred	1	0.5%

111 cases [60.7%] were included in non-neoplastic category, while 71 cases [38.8%] were of neoplastic type and 1 case [0.5%] was deferred

for diagnosis. The deferred case was received for primary diagnosis of gall bladder for which we received a cholecystectomy specimen. The cell morphology was not clearly discernible as the cells appeared crushed, enlarged and had hyperchromatic nuclei with moderate amount of cytoplasm. It was difficult to comment whether these features were reactive or neoplastic in nature hence the diagnosis was deferred.

Non-neoplastic Category

Non-Neoplastic **–** This category comprised of inflammatory, infective lesions like granulomatous inflammation including tuberculosis, sarcoidosis, acute suppurative pathology and reactive lesions like reactive hyperplasia of the lymph node and endometriosis along with cases which showed normal tissue. We had a total of 111 non-neoplastic cases.

Neoplastic category

Neoplastic- This included cases which were benign neoplasms, positive for malignancy (malignant neoplasm) and suspicious for malignancy. In our study, 9 cases [12.7%] were benign neoplasms, 51 cases [71.9%] were positive for malignancy and 11 cases [15.4%] were suspicious for malignancy.

Benign neoplasms included 9 cases of parathyroid adenoma which showed well encapsulated tumour with tumour cells arranged in nests. Individual tumour cells had hyperchromatic nuclei with abundant clear cytoplasm. No significant atypia, mitosis and necrosis was noted.

Positive for malignancy (PFM) included cases that were reported as malignant epithelial neoplasm like papillary epithelial neoplasm, adenocarcinoma, squamous cell carcinoma, mucinous neoplasm of ovary and atypical smooth muscle tumour and metastatic deposits.

These cases showed presence of tumor with cells exhibiting nuclear pleomorphism and had high nuclear: cytoplasmic ratio with moderate amount of cytoplasm and the morphology of cells varied according to the type of tumor. Few of the cases showed presence of atypical mitotic figures, areas of necrosis and hemorrhage. This included

specimens that came for primary diagnosis of the case, nodular deposits and lymph nodes.

Suspicious for malignancy (SFM) included 11 cases in which cells exhibited nuclear stratification and hyperchromasia with prominent nucleoli and moderate amount of cytoplasm but cell morphology was not clearly indicative of malignant neoplasm. This included specimens of resected margins and lymph nodes.

Table 7 : Neoplastic Frozen Section report (n=71)

Neoplastic Frozen section report	No. of Cases	Percentage
Positive for Malignancy	51	71.9%
Suspicious for malignancy	11	15.4%
Benign Neoplasms	9	12.7%

Correlation of Frozen section with histopathology

In our study of 183 cases all the cases were compared with the paraffin fixed section of the remaining tissue, out of which 163 cases [89.0%] were concordant and 19 cases [10.5%] were discordant with final histopathological diagnosis. 1 case with clinical suspicion of carcinoma gall bladder that came for primary diagnosis was deferred for diagnosis [0.5%].

Table 8: Correlation of frozen section with final histopathology report [n=183]

Correlation	No. of cases	Percentage
Concordant	163	89.0%
Discordant	19	10.5%
Deferred	1	0.5%

System wise distribution of Frozen section

Among 183 cases, 52 cases [28.4%] were of sentinel lymph nodes received in cases of carcinoma breast, 47 cases [25.7%] from female genital tract, 43 cases [23.4%] from gastrointestinal tract, 28 cases [15.4%] from head and neck, 7 cases [3.9%] from urinary tract and 6 cases [3.2%] from skin for frozen section analysis.

Table 9: System wise distribution of Frozen Section [n=183]

System	No of cases	Percentage
Sentinel lymph nodes	52	28.4%
Female genital tract	47	25.7%
Gastrointestinal tract	43	23.4%
Head And neck	28	15.4%
Urinary tract	7	3.9%
Skin	6	3.2%

System wise distribution of neoplastic and non-neoplastic cases

On analysing all the cases of frozen section system wise among the neoplastic category maximum number of malignant neoplasm and metastatic carcinomatous deposits were reported in female genital tract followed by sentinel lymph nodes sent in diagnosed cases of carcinoma breast, head and neck and gastrointestinal tract.

Suspicious of malignancy was reported maximum in gastrointestinal tract followed by female genital tract and sentinel lymph node.

Benign neoplasm was reported in head and neck region that was parathyroid adenoma.

In the non-neoplastic category, maximum cases of reactive lesions were reported in sentinel lymph nodes and highest number of normal tissue was reported in gastrointestinal tract.

Table 10: System wise distribution of neoplastic and non-neoplastic cases

	Sentinel lymph nodes	Female genital tract	Gastro-intestinal tract	Head and neck	Urinary tract	Skin
Neoplastic						
-Benign neoplasm	-	-	-	9	-	-
-Malignant neoplasm/ metastatic deposits	17	18	8	8	-	-
-Suspicious of malignancy	1	3	7	-	-	-
Non-neoplastic					-	-
-Inflammatory	-	-	-	1	-	-
-Infective	-	1	-	3		
-Reactive lesions (Reactive hyperplasia, Endometriosis, Benign cystic lesion, endometrial hyperplasia without atypia, disordered proliferative endometrium, Extracellular pools of mucin)	34	14	3	-	2	-
-Normal Tissue	-	11	25	7	5	6

Comparison of Concordance and Discordance rate system wise

Comparing the concordance rate and discordance rate system wise we observed concordance rate is 100% for skin and urinary tract respectively, 89.2% for head and neck, 88.4% for sentinel lymph nodes, 88.3% for gastrointestinal tract and 85.1% for female genital tract.

Discordance rate was highest in female genital tract of 14.9%, 11.7% in gastrointestinal tract, 11.6% for sentinel lymph nodes and 10.8% in head and neck region.

Table 11: **Comparison of Concordance and Discordance rate system wise**

System	Concordance rate (CR)	Discordance rate (DR)
Urinary tract	100%	0%
Skin	100%	0%
Head and neck	89.2%	10.8%
Sentinel lymph nodes	88.4%	11.6%
Gastrointestinal tract	88.3%	11.7%
Female genital tract	85.1%	14.9%

Head and neck Region

A total of 28 cases were received from head and neck region for frozen section out of which 9 cases [32.1%] were of parathyroid gland and tongue biopsy each, 6 cases [21.4%] from brain and 1 case each were of parotid gland, eyelid lesion, buccal mucosa and thyroid gland.

Table 12– Organ wise distribution in Head and neck [n=28]

Head and neck	No of cases	Percentage
Parathyroid gland	9	32.1%
Tongue biopsy	9	32.1%
Brain	6	21.4%
Parotid gland	1	3.6%
Thyroid gland	1	3.6%
Buccal mucosa biopsy	1	3.6%
Eyelid lesion	1	3.6%

Parathyroid gland

All 9 cases of frozen section were sent for primary diagnosis of the cases. Clinical diagnosis was available in all the cases and was parathyroid adenoma. All the cases showed presence of well encapsulated tumour with tumour cells arranged in nests. Individual tumour cells had hyperchromatic nuclei with abundant clear cytoplasm and adjacent compressed normal parathyroid tissue hence were reported as parathyroid adenoma. All 9 cases were concordant with final histopathological diagnosis as it showed the same morphology.

Tongue Biopsy

A total of 9 tongue biopsies were received out of which 5 were received to know the resected margin status in a diagnosed case of squamous cell carcinoma [55.6%] and 4 were for primary diagnosis [44.4%] of the case. 4 cases on frozen section showed presence of cellular tumor with tumour cells arranged in sheets. Individual tumour cells have hyperchromatic nuclei and moderate amount of cytoplasm. Focal area showed individual cell keratinisation. Hence, was reported as carcinoma. All 4 cases received for primary diagnosis, on final histopathology were reported as squamous cell carcinoma as they showed presence of individual cell keratinisation and few keratin pearls and intercellular bridges were present. The remaining 5 cases which

were received to know the resected margin status which showed no tumour infiltration on frozen section and final histopathological diagnosis. Hence all 9 cases were concordant with final histopathological diagnosis.

Brain

All 6 cases from brain were received for primary diagnosis. Clinical diagnosis was available in all 6 cases amongst which 4 cases had strong suspicion of malignant neoplasm, in 1 fungal granuloma was suspected and 1 case was clinically diagnosed as hemangioma. On frozen section 3 cases were categorised under neoplastic category and 3 cases were of non-neoplastic category. Frozen section in 3 cases [50%] were reported as malignant neoplasm; out of which 1 case was further classified as high grade astrocytoma, 2 cases [33.3%] showed necrosis with lymphocytes and 1 case [16.7%] was reported as granulomatous inflammation.

3 cases reported as malignant neoplasm showed presence of tumor exhibiting hypercellularity and was composed of cells with altered N:C ratio and scant to moderate cytoplasm. The cells exhibited moderate nuclear pleomorphism and hyperchromasia with frequent mitotic figures. Increased endothelial cell proliferation along with foci of necrosis was seen. Out of the 3 cases reported as malignant neoplasm and 1 case was further subclassified as high grade astrocytoma as the cellular tumor was present against a fibrillary background. 1 case was reported as granulomatous inflammation which showed epithelioid cell granulomas along with numerous multinucleated giant cells and few of which showed negative shadows of fungal hyphae. 2 cases showed large areas of necrosis with chronic inflammatory infiltrate only with no viable tumor cells.

Correlation of Frozen section with histopathology in Brain (n=6)

5 cases were concordant with the final histopathological diagnosis and 1 case was discordant. The 5 concordant cases included 3 cases reported as malignant neoplasm, 1 case of granulomatous

inflammation on frozen section which on final histopathology were reported as high grade gliomas and fungal granuloma respectively and 1 case on frozen section was reported as presence of large areas of necrosis with chronic inflammatory infiltrate only and on processing the remaining tissue also showed areas of necrosis only. The discordant case on final histopathology showed large areas of necrosis with presence of focal area of tumor present against a fibrillary background with individual tumour cells having hyperchromatic nuclei and moderate amount of cytoplasm along with atypical mitotic figures and thus was reported as glioblastoma multiforme.

Parotid gland

We received 1 case from parotid gland for primary diagnosis. On frozen section it showed nests of tumour cells exhibiting marked nuclear pleomorphism and hyperchromasia and thus was reported as suggestive of carcinoma. When the main specimen was processed the microscopy showed presence of tumour with variable morphological patterns. The tumour cells were arranged in nests separated by hyalinised fibrous stroma. Few cells had squamoid morphology. Interspersed were seen high grade areas with cells having hyperchromatic nuclei, prominent nucleoli and moderate amount of cytoplasm. Many mitotic figures were seen. Hence was reported as high grade carcinoma. After Immunohistochemistry this was reported as carcinoma ex pleomorphic adenoma. Therefore this case was concordant with final histopathological diagnosis.

Thyroid gland

We received 1 case from thyroid gland for primary diagnosis. On frozen section it showed well circumscribed nodule composed of thyroid follicles of variable sizes lined by flattened to cuboidal cells and were filled with colloid. These nodules were separated by fibrous septae and were infiltrated by chronic inflammatory infiltrate and thus was reported as multinodular goitre. Microscopic examination of the main specimen showed histology similar to that of frozen section and was reported as

multinodular goitre. Hence it was concordant with final histopathological diagnosis.

Buccal mucosa

We received 1 buccal mucosal biopsy for primary diagnosis. On frozen section it showed a lining of stratified squamous epithelium exhibiting an orderly cell maturation with areas of ulceration but no tumour. On processing the rest of the tissue sent for frozen section similar findings were noted. However, for final evaluation we received a hemimandibulectomy specimen from which multiple sections were processed which showed presence of cellular tumour with tumour cells arranged in nests and sheets. Individual tumour cells had vesicular nuclei, prominent nucleoli and moderate amount of cytoplasm. Individual cell keratinisation along with keratin pearls seen. Hence, was reported as squamous cell carcinoma. Therefore, Frozen section diagnosis was **discordant** with final histopathological diagnosis.

Eyelid lesion

We received 1 small specimen from eyelid for primary diagnosis of the case. On frozen section it showed fibrocollagenous and fibrofatty tissue only. Hence, was reported as no tumor seen. On processing the rest of the tissue sent for frozen section also showed fibrofatty and fibrocollagenous tissue only. However, on final histopathlogy we had received a large specimen, on processing the specimen and putting multiple sections microscopically it showed presence of tumor which was focally attached to the overlying epithelium and cells were arranged in nests with nuclear peripheral palisading. Individual tumor cells were basaloid in shape and had hyperchromatic nuclei with scant amount of cytoplasm. Retraction clefts were noted with surrounding fibrotic stroma. Hence was reported as basal cell carcinoma on final histopathology. Thus the frozen section diagnosis was **discordant** with final histopathological diagnosis.

Female genital tract

A total of 47 cases were received from female genital tract out of which 31 cases [65.9%] were from ovary, 9 cases [19.2%] were from endometrium, 6 cases [12.8%] were from cervix and 1 case [2.1%] of retained products were received for frozen section examination.

Table 13: Organ wise distribution in female genital tract [n=47]

Female genital tract	No of cases	Percentage
Ovary	31	65.9%
Endometrium	9	19.2%
Cervix	6	12.8%
Retained products	1	2.1%

Ovary [n=31]

All 31 cases of ovary were sent for primary diagnosis of the cases. Out of this for 27 cases we received oopherectory specimens and in 4 cases we received small specimen. Clinical diagnosis was available in all the cases and in all cases carcinoma ovary was suspected. Out of the 31 cases 12 cases were reported as malignant neoplasm, 1 case was reported as suspicious of malignancy and all the other cases were non-neoplastic in nature which included endometriosis, necrosis and normal ovarian stroma. So among these 31 cases, 7 cases [22.5%] were reported as malignant epithelial neoplasm, 2 cases [6.5%] showed papillary epithelial neoplasm, 2 cases [6.5%] were reported as mucinous neoplasm, 1 case [3.2%] showed borderline serous tumour, 1 case [3.2%] showed atypical squamous proliferation, 4 cases [12.9%] were reported as benign cystic lesion, 7 cases [22.5%] were reported as endometriosis, 6 cases [19.5%] showed ovarian stroma only with no tumour, 1 case [3.2%] showed necrosis only.

Correlation of Frozen section with histopathology in ovary (n=31)

Out of the total 31 cases, 25 cases [80.6%] were concordant and 6 cases [19.4%] were discordant with the final histopathological diagnosis.

Among these 31 cases, out of 7 cases reported as malignant epithelial neoplasm on frozen section, 5 were reported as adenocarcinoma and were concordant with final diagnosis and the remaining 2 cases were reported as adult granulosa cell tumor on final histopathological diagnosis and hence were discordant. These 2 discordant cases showed a variety of architectural patterns with mostly diffuse pattern of tumor cells. The individual tumor cells had uniform, pale, round to oval nuclei with irregular nuclear membrane and nuclear grooves which could not be identified on frozen section due to freezing artifacts. Reticulin stain was getting highlighted around the tumor nests. Hence, were reported as adult granulosa cell tumor.

Out of the 2 cases reported as papillary epithelial neoplasm on frozen section, 1 case showed presence of cellular tumor with tumor cells arranged in small nests and papillae. The cells exhibited mild nuclear atypia with < 3 fold variation in size and a central nucleolus. Mitotic figures were 3 /10 hpf along with invasion and few psammoma bodies were seen. Hence was reported as serous carcinoma, low grade. The other case showed presence of a cellular tumor with focus of micro-invasion seen as <5 mm in greatest diameter. Hence was reported as serous borderline tumor and both these cases were concordant with final histopathological diagnosis.

2 cases reported as mucinous neoplasm were concordant with the final histopathological diagnosis as 1 case was reported as mucinous cystadenoma as there were glands lined by simple non stratified mucinous epithelium. Individual tumor cells had basally located small hyperchromatic nuclei and moderate amount of cytoplasm with no cytological atypia/ invasion and the other case was reported as mucinous carcinoma as it showed expansile growth pattern with

minimal intervening stroma and glands exhibited marked nuclear atypia.

1 case reported as borderline serous tumor on frozen section was discordant on final histopathological examination as it showed presence of cysts and papillae lined by non stratified cuboidal to columnar epithelial cells embedded in prominent fibromatous stroma and constituted <10% of the tumor. Hence was reported as serous cystadenofibroma.

1 case reported as atypical squamous proliferation on frozen section but on final histopathological examination after processing multiple sections showed presence of a cellular tumor with cells arranged in back to back arrangement of variably sized glands. The cells had round to oval nuclei, open chromatin and moderate amount of atypia. Squamous morules were seen as round aggregates of bland to spindled cells which were identified on frozen section. Thus this was reported as endometrioid carcinoma and was discordant with final histopathological findings.

Out of the 4 cases reported as benign cystic lesion on frozen section 3 cases were concordant with final histopathological diagnosis as it showed presence of follicular cyst, corpus albicans and 1 case showed large areas of haemorrhage with no viable cellular areas, hence was reported as torsion ovary however, 1 case showed presence of Brenner's tumor as the tumour cells were arranged in small nests of bland transitional epithelium in a dense fibromatous stroma. The nests showed microcystic spaces containing eosinophilic material. The individual tumour cells had elongated nuclei with fine chromatin and visible nucleoli and moderate amount of cytoplasm. Hence this 1 case was discordant with the final histopathological findings.

6 cases on frozen section which showed presence of ovarian stroma only; on final histopathological diagnosis performed of whole ovary 3 cases showed endometriosis and one showed presence of simple cyst seen as denuded cyst wall with focal lining of flattened cuboidal

epithelium and 2 cases showed corpus albicans thus these 6 cases were concordant with final histopathological diagnosis. 7 cases reported as endometriosis on frozen section were concordant with the final histopathological findings.

1 case reported as only necrosis, on final histopathological findings performed on entire ovary showed presence of a cellular tumor with tumor cells arranged in reticular/ microcytsic pattern. The individual tumor cells exhibited variable atypia with clear cytoplasm and hyaline globules. Schillar duval bodies were also noted. Hence was reported as non seminomatous germ cell tumor- Yolk sac tumor, This was discordant with final histopathological findings.

Table 14: Discordant cases of frozen section with histopathology in ovary

Frozen section diagnosis	Final Histopathology diagnosis	Concordance
Borderline serous tumor	Serous cyst adenofibroma	Discordant
Atypical Squamous metaplasia	Endometrioid carcinoma	Discordant
Malignant epithelial neoplasm	Adult granulosa cell tumor	Discordant
Necrosis	Non seminomatous germ cell yolk sac tumor	Discordant
Benign cystic Lesion	Brenner's tumor	Discordant

Endometrium [n=9]

All 9 cases were sent for primary diagnosis of the cases. Clinical diagnosis was available in all the cases and in all cases carcinoma endometrium was suspected. Out of these 9 cases, in 2 cases we received hysterectomy specimen and for rest 7 cases we received endometrial curetting's. On frozen section, 1 case was suspicious for malignancy and 8 cases were of non-neoplastic category which included, endometrial hyperplasia without atypia, disordered proliferative endometrium, proliferative endometrium, secretory endometrium. On analysing frozen section 4 cases [44.4%] were reported as proliferative endometrium, 1 case [11.1%] was diagnosed as secretory endometrium and 1 case [11.1%] was diagnosed as disordered proliferative endometrium, 2 cases [22.2%] were reported as endometrial hyperplasia without atypia, 1 case [11.1%] was diagnosed as atypical smooth muscle tumor.

On frozen section microscopy 4 cases showed presence of straight tubular glands lined by cells having basally located nuclei and moderate amount of cytoplasm along with mitotic figures seen both in the epithelium and stroma. The stroma was highly cellular hence, was diagnosed as proliferative endometrium. 1 case showed presence of coiled endometrial glands which are lined by tall columnar cells having basally located vacuoles and nuclei pushed to the centre. The stroma was highly vascular and edematous, hence was diagnosed as secretory endometrium. 2 cases showed increased gland to stroma ratio with back to back arrangement of glands lined by columnar epithelial cells having basally located nuclei and were reported as endometrial hyperplasia without atypia. 1 case showed normal gland to stroma ratio with focal glandular crowding and branching amidst a compact stroma and thus was diagnosed as disordered proliferative endometrium.

1 case showed presence of atypical smooth muscle tumor with tumor cells arranged in fascicles exhibiting nuclear atypia and tumor giant cells. However, there were no necrosis/ atypical mitosis noted. On

processing the hysterectomy specimen of this case microscopy showed presence of a cellular tumor with tumor cells arranged in intersecting fascicles having moderate degree of nuclear pleomorphism and moderate amount of cytoplasm. Intermingled are seen mononucleated and few multinucleated bizzare cells having hyperchromatic nuclei and smudged chromatin. Areas of cystic change noted. Mitosis was <10/10 hpf noted. However, no necrosis/ lymphovascular invasion/infiltrative borders were seen. Thus, it was diagnosed as smooth muscle tumor of uncertain malignant potential.

Correlation of Frozen section with histopathology in endometrium (n=9)

Among the 9 cases, 8 cases [88.8%] were concordant and 1 case [11.2%] was discordant with final histopathological diagnosis. The discordant case was reported as endometrial hyperplasia without atypia on frozen section, however on processing the hysterectomy specimen it showed presence of cellular tumor with tumor cells arranged in glandular architecture with individual cells having columnar nuclei exhibiting mild nuclear atypia, inconspicuous nucleoli with eosinophilic and granular cytoplasm. There was stromal invasion with loss of intervening stroma hence was diagnosed as endometrioid carcinoma.

Cervix [n=6]

All 6 cases of frozen section were sent for primary diagnosis of the cases with high suspicion of carcinoma cervix. On frozen section, 2 cases were malignant and 4 cases showed normal tissue only.

Out of the 6 cases, 2 cases [33.3%] were reported as squamous cell carcinoma, 2 cases [33.3%] showed presence of endocervical tissue, 1 case [16.7%] showed presence of stratified squamous epithelium and 1 case [16.7%] showed just the presence of fibrofatty tissue.

The 2 cases reported as squamous cell carcinoma showed presence of a cellular tumour with tumour cells arranged in nests and sheets. Individual cells have polygonal shape with vesicular nuclei, prominent

nucleoli and moderate amount of cytoplasm. Individual cell keratinization, keratin pearls and intercellular bridges were also formed and on final histopathology as well these cases were reported as squamous cell carcinoma. 2 cases on frozen section showed presence of endocervical glands seen as tall columnar epithelium with no edema/fibrosis/ evidence of malignancy seen. 1 case showed just a lining of stratified squamous epithelium with orderly cell maturation and 1 case showed just presence of fibrofatty tissue with no tumor infiltration. Thus these 4 cases on final histopathology showed features of chronic cervicitis. Hence, all the cases were concordant with the final histopathological diagnosis.

Retained products of conception [n= 1]

One case of retained products of conception was received for the primary diagnosis as clinically they wanted to rule out gestational trophoblastic tumor. Frozen section showed presence of chorionic villi and no evidence of malignancy. This was concordant with the final histopathological diagnosis.

Sentinel lymph nodes in cases of carcinoma breast [n=52]

52 cases [100%] of sentinel lymph nodes in diagnosed cases of carcinoma breast was sent to look for metastasis. Among 52 cases, 17 cases were malignant, 34 cases were non-neoplastic and 1 case was suspicious of malignancy.

Out of the 52 sentinel lymph nodes, 34 cases were reported as reactive hyperplasia [65.4%], 17 cases were reported as metastatic carcinomatous deposits [32.7 %] and 1 case was reported as suspicious for malignancy [1.9%]. 34 cases reported as reactive hyperplasia showed presence of maintained nodal architecture with lymphoid follicles and reactive germinal centres and sinuses were dilated and filled with histiocytes. However, no evidence of malignancy was seen. 17 cases reported as metastatic carcinomatous deposits showed effaced nodal architecture and a cellular tumor with tumor cells arranged in nests and sheets. Individual tumor cells had

hyperchromatic nuclei and moderate amount of cytoplasm. 1 case reported as suspicious of malignancy showed maintained nodal architecture with presence of few nests of large cells having hyperchromatic nuclei and moderate cytoplasm.

Correlation of Frozen section with histopathology in Sentinel lymph nodes in cases of carcinoma breast (n=52)

Out of the total 52 cases, 46 cases [88.4%] were concordant and 6 cases [11.6%] were discordant with the final histopathological diagnosis. 5 cases reported as reactive hyperplasia on frozen section was discordant with final histopathological findings as they showed effaced nodal architecture and a cellular tumor with tumor cells arranged in nests and sheets. Individual tumor cells had hyperchromatic nuclei and moderate amount of cytoplasm. 1 case reported as suspicious for malignancy on frozen section showed reactive hyperplasia of the lymph node on final histopathological examination.

Table 15: Discordant cases of Frozen section with histopathology in sentinel lymph node in cases of carcinoma breast

Frozen section Diagnosis (No. of cases)	Final Histopathology Diagnosis (No. of cases)	Concordance
Reactive hyperplasia(5)	Metastatic deposits(5)	Discordant
Suspicious for malignancy	Reactive hyperplasia	Discordant

Skin [n=6]

All 6 cases were sent to know the resected margin status in diagnosed cases of basal cell carcinoma of skin. All the cases were free of tumor and were concordant with final histopathology report.

Urinary tract [n=7]

A total of 7 cases were received for frozen section out of which 5 cases [71.4%] were sent to know the resected margin status in diagnosed cases of carcinoma urinary bladder and 2 cases [28.6%] were sent to look for metastasis in lymph node in a diagnosed case of carcinoma penis. 5 cases of resected margins showed no tumor and 2 cases of lymph nodes showed reactive hyperplasia. On processing the final histopathology specimens all of them showed the same findings as that of frozen section hence, all 7 cases were concordant with the final histopathological diagnosis.

Gastrointestinal tract [n=43]

We received a total of 43 cases from gastrointestinal tract out of which 14 cases [32.5%] each were of gall bladder and pancreas followed by 5 cases of peritoneum [9.3%] and least number of cases were from duodenum that is 1 in number.

Table 16: Organ wise distribution in Gastrointestinal tract [n=43]

Gastrointestinal tract	No of cases	Percentage%
Gall bladder	14	32.5
Pancreas	14	32.5
Peritoneum	5	11.7
Appendix	4	9.4
Rectum	3	6.9
Esophagus	2	4.7
Duodenum	1	2.3

Esophagus [n=2]

We had 2 cases of frozen section which were sent to look for metastasis in case of carcinoma esophagus for which we received nodular deposits. One case [50%] was reported as carcinoma as it showed presence of a cellular tumor with tumor cells arranged in glandular configuration and individual tumor cells had vesicular nuclei, prominent nucleoli and moderate amount of cytoplasm and the other case [50%] showed presence of areas of sclerosis only and no tumor. Both the cases were concordant with final histopathological diagnosis as one was reported as adenocarcinomatous deposits and other was reported as presence of areas of sclerosis with no tumor deposits.

Duodenum [n=1]

We received one case of duodenal mass for primary diagnosis for which we received a segment of intestine. Frozen section was reported as epithelial neoplasm as it showed presence of a cellular tumor with tumor cells arranged in sheets and nests and individual tumor cells had vesicular nuclei and moderate amount of cytoplasm. This was concordant with the final histopathology report which showed presence of tumor of the similar morphology. Nuclear moulding and areas of necrosis with brisk mitosis was noted. Hence it was reported as neuroendocrine carcinoma on final histopathology.

Peritoneum [n=5]

We received 5 peritoneal biopsies to look for metastasis in diagnosed cases of various carcinomas. Out of the 5 cases, 3 cases were reported as suspicious for malignancy and 2 cases were reported as carcinoma.

We received one case of peritoneum biopsy to look for metastatic deposits in a diagnosed case of carcinoma ovary. In this case frozen section was reported as suspicious for malignancy as there were few cells exhibiting enlarged pleomorphic hyperchromatic nuclei with moderate amount of cytoplasm. Final histopathology report showed areas of fat necrosis seen as necrotic fat cells, basophilic calcium

deposits, and an inflammatory reaction. This was discordant with final histopathological diagnosis as there were no tumor cells.

2 cases of frozen section were sent to look for metastasis in a diagnosed case of carcinoma stomach. Both the cases were reported as suspicious for malignancy on frozen section as there were few atypical cells with hyperchromatic nuclei exhibiting mild nuclear pleomorphism. Both the cases were concordant with final histopathological findings as 1 case showed metastatic carcinomatous deposits seen as fibrocollagenous tissue which was infiltrated by tumor cells, the tumor cells were arranged in glandular configuration and exhibited mild nuclear pleomorphism and had hyperchromatic nuclei with moderate amount of cytoplasm. Other case showed presence of fibrocollagenous tissue with infiltration by tumor cells and individual tumor cells had eccentrically placed hyperchromatic nuclei and moderate amount of vacuolated cytoplasm. Extracellular pools of mucin seen. Signet ring cell proportion was >50% of all the tumor cells hence was reported as Signet ring cell carcinoma.

2 cases of frozen section were sent to look for metastasis in diagnosed case of hepatocellular carcinoma. Both the cases were reported as carcinoma on frozen section and final histopathological diagnosis in both the cases was metastatic carcinomatous deposits. Hence both the cases were concordant with final histopathological findings.

Among the 5 cases 1 case was discordant and 4 cases were concordant with final histopathological diagnosis.

Gall bladder [n=14]

We received a total of 14 cases out of which 9 cases (64.4%) were for primary diagnosis for which we received cholecystectomy specimen, 3 cases (21.4%) were sent to know the resected margin status for which we received bile duct margin and 2 cases (14.2%) were to look for metastasis for which we received nodular deposits over liver.

Out of the 14 cases of gall bladder, 1 case was malignant, 2 cases were suspicious of malignancy, 10 cases showed normal tissue and 1 case was deferred.

In 10 cases (71.6%) of frozen section showed no tumor; out of these 10 cases, 6 cases were for primary diagnosis of the case, 2 were sent to know the resected margin status and 2 cases were sent to look for metastasis. Out of these 10 cases, 9 cases showed chronic inflammatory infiltrate with thickened wall and 1 case showed presence of only hepatocytes.

1 case was reported as carcinoma as it showed presence of cellular tumor with tumor cells arranged in glandular configuration with individual tumor cells having vesicular nuclei, prominent nucleoli and moderate amount of cytoplasm. The individual glands were incompletly formed with haphazardly placed tumor cells.

1 case was suspicious of malignancy as it showed presence of few singly scattered enlarged cells having hyperchromatic nuclei and moderate amount of cytoplasm. 1 case was reported as presence of dysplasia of the biliary epithelium seen as cells exhibiting nuclear stratification and had high N:C ratio, hyperchromatic nuclei and moderate amount of cytoplasm.

1 case that was deferred for diagnosis was of a 73 year old male with a clinical diagnosis of carcinoma gall bladder. We had received a cholecystectomy specimen for primary diagnosis of the case. The cell morphology was not clearly discernible. The cells appeared crushed and had a hyperchromatic nuclei with moderate amount of cytoplasm with few glands exhibiting nuclear stratification and hyperchromasia. It was difficult to ascertain whether these were reactive changes or neoplastic hence was deferred for diagnosis.

Correlation of Frozen section with histopathology in gall bladder (n=14)

Out of the 14 cases, 12 cases were concordant and 1 case was discordant with the final histopathological diagnosis and 1 case was deferred. 1 discordant case on frozen section was reported as suspicious of malignancy but on final histopathology showed areas of fibrosis, chronic inflammatory infiltrate and Rokitansky aschoff sinuses hence was reported as chronic cholecystitis.

Appendix [n=4]

All the 4 cases of frozen section were sent for primary diagnosis of the cases. 3 cases (75%) showed no tumor infiltration and 1 case showed reported as presence of extracellular mucin only. The 3 cases on frozen section which showed no tumor showed presence of thickened wall with acute and chronic inflammatory cells.

Correlation of Frozen section with histopathology in Appendix[n=4]

Out of 4 cases, 2 cases were concordant and 2 cases were discordant with final histopathological diagnosis**.** Out of the 2 discordant cases 1 case on frozen section showed thickened wall with acute and chronic inflammatory cells. However on final histopathology showed filiform pattern of growth of tumor cells with tumor cells having tall cytoplasmic mucin vacuoles compressing the nucleus. There is mild degree of atypia with areas of fibrosis and hyalinisation. Hence, was reported as low grade mucinous appendiceal neoplasm. Other discordant case on frozen section showed presence of only extracellular mucin. However, on final histopathological diagnosis was reported as low grade mucinous appendiceal neoplasm.

Table 17: Discordant cases of Frozen section with histopathology in Appendix

Frozen section Diagnsois	Final Histopathology Diagnosis	Concordance
No tumor	Low grade appendiceal neoplasm	Discordant
Extracellular mucin	Low grade appendiceal neoplasm	Discordant

Rectum [n=3]

A total of 3 cases were received, out of which 2 cases [66.7%] were sent to know the resected margin status in diagnosed case of carcinoma rectum and one case [33.3%] was received for primary diagnosis. We received LAR specimen in 1 case, resected margin and and a polyp biopsy for FS analysis.

On frozen section, 2 cases (66.7%) showed no tumor and 1 case (33.3%) that was received for primary diagnosis of the case was reported as villous adenoma with dysplasia.

Correlation of Frozen section with histopathology in Rectum [n=3]

2 cases were concordant and 1 case was discordant with final histopathological diagnosis. The 1 discordant case on frozen section showed presence of tumor arranged in villous and glandular configuration with cells exhibiting nuclear stratification and hyperchromasia displaying loss of polarity. But there was no frank evidence of invasion seen. On final histopathological case there was presence of cellular tumor with tumor cells arranged in glandular configuration with tumor cells exhibiting mild nuclear pleomorphism and individual cells had vesicular nuclei, prominent nucleoli and moderate amount of cytoplasm. The tumour was extending upto the muscularis propria. Hence was reported as adenocarcinoma, moderately differentiated.

Pancreas [n=14]

We received a total of 14 cases out of which 11 cases (78.7%) were sent to know the resected margin status, 2 cases (14.2%) were sent to look for metastasis and one case for primary diagnosis of the case.

Out of the 14 cases, 11 cases received for resected margin status showed no tumor. 1 case received to look for metastasis showed presence of cellular tumor in glandular configuration with tumor cells having vesicular nuclei, prominent nucleoli and moderate amount of cytoplasm hence was reported as adenocarcinoma. Other case received to look for metastasis showed no tumor. 1 case received for primary diagnosis was reported as highly suspicious of malignancy which on final histopathological diagnosis was reported as adenocarcinoma. All the cases were concordant with final histopathological diagnosis as they showed same findings.

Overall False positive cases amongst discordant cases [n=4]

There were 4 false positive cases in our study one case each from peritoneal biopsy, sentinel lymph node, ovary and gall bladder. In all these 4 cases there was change in surgical management based of our frozen section report and more extensive surgery was done.

Table 18: Overall False positive cases amongst discordant cases [n=4]

Organ	No of cases	Frozen section report	Final histopathology report	Causes of discordance
Peritoneal biopsy	1	Suspicious of malignancy	Free of tumor	Freezing artifacts
Sentinel lymph node	1	Suspicious of malignancy	Reactive hyperplasia	Interpretation error
Ovary	1	Borderline serous tumor	Serous cystadenofibroma	Interpretation error
Gall bladder	1	Suspicious of malignancy	Chronic cholecystitis	Freezing artifacts

False positive rate: $\frac{\text{False positive}}{\text{True positive}} \times 100 = \frac{4}{60} \times 100 = 6.6\%$

Overall False negative cases amongst discordant cases[n=15]

There were a total of 15 cases that were false negative in our study with maximum of 3 cases from ovary followed by 5 cases of sentinel lymph node in diagnosed case of carcinoma breast, 2 case from appendix and 1 case each from brain, buccal mucosa, eyelid lesion, endometrial currettings and rectum.

Table 19: Overall False negative cases amongst discordant cases[n=15]

Organ	No of cases	Frozen section report	Histopathology report	Causes of discordance
Appendix	1	No tumor	Low grade appendiceal neoplasm	Sampling error by pathologist
	1	Extracellular pools of mucin	Low grade appendiceal neoplasm	Sampling error by pathologist
Brain	1	Necrosis	Glioblastoma multiforme	Sampling error by surgeon
Buccal mucosa	1	Areas of ulceration	Squamous cell carcinoma	Sampling error by surgeon
Eyelid lesion	1	Fibrofatty and fibrocollegnous tissue	Basal cell carcinoma	Sampling error by surgeon
Endometri-al currettings	1	Endometrial hyperplasia without atypia	Endometrioid carcinoma	Sampling error by surgeon
Ovary	3	Benign cystic lesion	Brenner's tumor	Sampling error by surgeon
		Atypical squamous metaplasia	Endometriod carcinoma	Sampling error by surgeon
		Necrosis	Non seminotous germ cell tumor- yolk sac tumor	Sampling error by surgeon
Sentinel lymph node	5	Reactive hyperplasia	Metastatic deposits	Sampling error by pathologist
Rectum	1	Villous adenoma with dysplasia	Adenocarcinoma	Sampling error by surgeon

False negative rate: $\frac{\text{False negative}}{\text{True negative}}$ X 100 15/104X 100 = 14.4%

In patients which were reported to have a malignant tumor on final histopathology have a risk of undergoing second surgery because of frozen section report as no extensive protocol for surgery was followed during the 1st procedure.

Analysis of sensitivity, specificity, false positive, false negative rates of frozen section overall

183 specimens were adequate for evaluation on frozen section. Frozen section was reported in 60 cases as true positive (positive on paraffin section) and 4 were false positive (negative on paraffin section). Frozen section was reported in 104 cases as true negative
(negative on paraffin section) and 15 were false negative (positive on paraffin section).

A) Sensitivity of frozen section

$\frac{\text{True positive}}{\text{True positive + False negative}}$ x 100 = 60/60+15 x100=**80.0%**

B) Specificity of frozen section

$\frac{\text{True negative}}{\text{True negative + False positive}}$ x 100 = 104/104+4 x100 =**96.2%**

C) Positive predictive value of frozen section

$\frac{\text{True positive}}{\text{True positive+ false positive}}$ x 100 = 60/60+4x100= **93.7%**

D) Negative predictive value of frozen section

$\frac{\text{True negative}}{\text{True negative+ false negative}}$ x 100 = 104/104+15x100=**87.3%**

Sensitivity, specificity, PPV, NPV, concordance rate and discordance rate for resected margins status on frozen section

True positive: 4/34

True negative: 30/34

False positive: 0/34

False negative: 0/34

1)Sensitivity: $\frac{\text{True positive}}{\text{True positive + False negative}} \times 100 = \frac{4}{4+0} \times 100 = 100\%$

2)Specificity: $\frac{\text{True negative}}{\text{True negative + False positive}} \times 100 = \frac{30}{30+0} \times 100 = 100\%$

3)PPV: $\frac{\text{True positive}}{\text{True positive+ false positive}} \times 100 = \frac{4}{4+0} \times 100 = 100\%$

4)NPV: $\frac{\text{True negative}}{\text{True negative+ false negative}} \times 100 = \frac{30}{30+0} \times 100 = 100\%$

5) Concordance rate:

$$\frac{\text{True positive + True negative}}{\text{Total evaluation}} \times 100 = \frac{4+30}{34} \times 100 = 100\%$$

6) Discordance rate:

$$\frac{\text{False positive+ False negative}}{\text{Total evaluation}} \times 100 = \frac{0+0}{34} \times 100 = 0\%$$

Sensitivity, specificity, PPV, NPV, concordance rate and discordance rate to look for metastasis on frozen section

True positive: 21/64

True negative: 36/64

False positive: 2/64

False negative: 5/64

1)Sensitivity: True positive / True positive + False negative x 100 = 21 / 21+5 x 100 = 80.7%

2)Specificity: True negative / True negative + False positive x 100 = 36 / 36+2 x 100 = 94.7%

3)PPV: True positive / True positive+ false positive x 100 = 21 / 21+2 x 100 = 91.3%

4)NPV: True negative / True negative+ false negative x 100 = 36 / 36+5 x 100 = 87.8%

5)Concordance rate:

True positive+ True negative / Total evaluation x 100 = 21+36 / 64 x 100 = 89%

6) Discordance rate:

False positive+ False negative / Total evaluation x 100 = 2+5 / 64 x 100 = 10.9%

Sensitivity, specificity, PPV, NPV, concordance rate and discordance rate for primary diagnosis of frozen section

True positive: 34/85

True negative: 38/85

False positive: 2/85

False negative: 10/85

Deffered :1/85

1)**Sensitivity**: $\frac{\text{True positive}}{\text{True positive + False negative}} \times 100 = \frac{34}{34+10} \times 100 = 77.2\%$

2)Specificity: $\frac{\text{True negative}}{\text{True negative + False positive}} \times 100 = \frac{38}{38+2} \times 100 = 95.0\%$

3)PPV: $\frac{\text{True positive}}{\text{True positive+ false positive}} \times 100 = \frac{34}{34+2} \times 100 = 94.4\%$

4)NPV: $\frac{\text{True negative}}{\text{True negative+ false negative}} \times 100 = \frac{38}{38+10} \times 100 = 79.1\%$

5)Concordance rate:

$\frac{\text{True positive+ True negative}}{\text{Total evaluation}} \times 100 = \frac{34+38}{85} \times 100 = 84.7\%$

6) Discordance rate:

$\frac{\text{False positive+ False negative}}{\text{Total evaluation}} \times 100 = \frac{2+10}{85} \times 100 = 14.1\%$

Comparison of sensitivity, specificity, PPV, NPV, concordance rate and discordance rate among the indications of frozen section

Sensitivity, specificity, PPV,NPV, concordance rate and discordance rate were highest in diagnosis of resected margin status followed by to look for metastasis and least in primary diagnosis

Table 20: Comparison of sensitivity, specificity, PPV, NPV, concordance rate and discordance rate among the indications of frozen section

Indications	Sensitivity	Specificity	PPV	NPV	Concordance rate	Discordance rate
Status of Resected margin	100%	100%	100%	100%	100%	0%
To look for Metastasis	80.7%	94.7%	91.3%	87.8%	89%	10.9%
Primary diagnosis	77.2%	95.0%	94.4%	79.1%	84.7%	14.1%

Causes of discordance in frozen section diagnosis and final histopathological diagnosis

Among the 19 discordant cases including the false positive and false negative cases the most common cause of discordance was sampling error from surgeon side followed by sampling error by the pathologist, freezing artifacts due to the technique and least due to the interpretation error.

Among the 4 false positive cases, 2 cases [10.5%] were discordant due to the interpretation error by the pathologist and 2 cases [10.5%] were

discordant because of the freezing artifact leading to interpretation difficulty.

In the 15 false negative cases, 8 cases [42.2%] were discordant due to the sampling error of the surgeon and 7 cases [36.8%] were discordant due to the sampling error of the pathologist.

Table 21: Causes of discordance in frozen section and final histopathological diagnosis

Various Causes of discordance	No of cases	Percentage%
Sampling error by Surgeon	8	42.2
Sampling error by pathologist	7	36.8
Freezing artifacts	2	10.5
Interpretation error	2	10.5

Among the 19 discordant cases 8 cases were due to the sampling error by surgeon as on processing the remaining tissue sent by the surgeon for frozen section also showed the same findings as were reported however, on receiving the entire specimen that was taken out during surgery showed presence of malignancy.

7 cases which were discordant due to the sampling error by the pathologist as on processing the remaining tissue sent for frozen section by the surgeon showed evidence of malignancy.

Remaining 2 cases were due to the freezing artifacts and air drying artifacts which caused the cells to be splayed out with smudgy chromatin and indistinct cell borders and 2 cases were discordant due to the interpretation error by the pathologist.

DISCUSSION

Tissue specimen taken from the patient by doing a biopsy or a surgery is usually assessed by the pathologist after the specimen is adequately fixed in formalin. However, occasionally surgeons need pathologic information more urgently thus, they request for an intra-operative consultation on the tissue that is being taken out (known as frozen section). The examination is made while the patient is on the operating table.

This study was conducted in the Department of Pathology at Dayanand Medical College and Hospital, Ludhiana over a period of 1 year prospectively from 1st March 2021- 28th February 2022 to assess the efficacy and utility of the technique in managing the patient and following the treatment protocol.

In our study period we received a request for 183 frozen sections in our department which were analysed. The time of receiving the specimen in the department and the time at which the frozen section report was informed to the surgeon was noted for every case as it was a critical parameter. After reporting the frozen section, the remaining tissue was fixed in formalin and hematoxylin and eosin stained sections were examined. A comparison was made between the frozen section and final histopathological findings and efficacy of the technique was assessed.

Age and Gender

The commonest age group who underwent frozen section was between 41 to 50 years comprising of 52 cases [28.5%], alike the study done by Diwagar N et al [32] in 2019 who also showed similar findings with most common age group to be 30-50 years. Another study done by Shetty PP et al [33] in 2019 also showed the most common age group for frozen section to be 40-49 years.

In our present study overall frozen section was performed more in females constituting 146 cases [79.8%] of the patients with a male to female ratio of 1:3.9 which is in comparison with the study done by

Tangde A et al [22] in year 2019 which comprised of 73 female, 10 males and male to female ratio of 1:7.3 . Study done by Nithin diwagar et al [32] in 2019 also showed that majority of cases of frozen section were done for females constituting 91% and 9 % were male with a male to female ratio of 1:10.1. This is probably due to the fact that gynaecologist are routinely doing the procedure to know whether a cystic lesion is neoplastic or not and if neoplastic whether it is benign or malignant and thus manage the patient accordingly. The other reason is increased number of cases sent to assess presence of metastasis in the sentinel lymph nodes among the diagnosed cases of carcinoma breast and decide about the treatment and surgical protocol that has to be followed.

Indications of Frozen section

The various indications of doing the frozen section were to establish the nature of a lesion whether neoplastic or nonneoplastic and further whether it is benign or malignant so that the surgical procedure can be planned accordingly while the patient is on the operating table. It was also done to determine the adequacy of resected margins in a diagnosed case of malignant tumor. Another indication was to establish the evidence of metastasis in the sentinel lymph nodes and to look for metastatic deposits in omentum and peritoneum. We also tried to determine the etiology of nonneoplastic lesions whether it is tissue inflammation or infective and if infective, depending upon the type of granulomas or additional findings the etiology was ascertained.

In our present study in 85 cases [46.5%] frozen section was requested to know the primary diagnosis of various organs, 64 cases [34.9%] were to look for metastasis to the sentinel lymph node, omentum or peritoneum and 34 cases [18.6%] were sent to assess the resected margin status in diagnosed case of malignant tumor. These are in comparison with study done by Zinzala U.C., Roy S et al, Tangde A et al and Chbani L et al in which the most common indication of doing frozen section was primary diagnosis of the lesion.

Table 22: Indications of frozen section

Study done by	Year of study	Primary diagnosis	Resected margin status	Metastasis
Zinzala U.C.[34]	2020	61.2%	35.6%	3.2%
Tangde A et al[22]	2019	92.8%	-	7.2%
Roy S et al [35]	2013	65.9%	30.6%	3.8%
Chbani Let al[36]	2012	85.4%	7.3%	4.3%
Present study	2021	46.5%	34.9%	18.6%

Type of Specimen received for frozen section

Out of total 183 specimens, in 136 cases [74.3%] we received small specimens while 47 specimens [25.7%] were large. Small specimens included endometrial currettings, resected margins, sentinel lymph nodes and suspected nodules of metastatic deposits. The large specimens included hysterectomies, cholecystectomies, appendicectomies, ovarian masses, thyroidectomies, parathyroidectomies and a segment of intestine. The large specimens affected the revert time which was prolonged as in some cases we had to put in multiple pieces to reach to a diagnosis.

Time taken for evaluation of frozen section

It was calculated from the time the specimen was received in our department to the time the report of frozen section was informed to the operating surgeon. In 78 cases [42.6%] it was 21-30 minutes followed by 91 cases [49.9%] in which the revert time was 31-40 minutes. Mean time taken was 36.3 minutes. Least amount of time taken was 26 minutes. Maximum time taken was 55 minutes in 2 cases. These 2 cases were for primary diagnosis with clinical suspicion of carcinoma endometrium and carcinoma ovary. For both these cases we received hysterectomy specimen and a large ovarian mass respectively where we had put in multiple sections for the diagnosis. It is not in concordance with the studies done by Laakman JM [37] in 2021 and Novis DA [38] as they showed there mean turn around time was 21.7

minutes and 20 minutes respectively for all the organs. In our present study the time taken was more as in our institute as the frozen section is seen by minimum 2 pathologists and cross consultation was done.

Frozen section Diagnosis

In our present study out of 183 cases, 111 cases [60.7%] were grouped under Non-neoplastic category, 71 cases [38.8%] were put under neoplastic category and in 1 case [0.5%] diagnosis was deferred. This is in comparison to the study done by Kuna N[39] in which 66% cases were of non- neoplastic pathologies and 34% cases were reported as neoplastic pathologies.

Correlation of frozen section diagnosis with final histopathological diagnosis

In our present study, 163 cases [89.0%] of frozen section were concordant and 19 cases [10.5%] were discordant with final histopathological diagnosis. 1 case [0.5%] with clinical suspicion of carcinoma gall bladder that came for primary diagnosis was deferred for diagnosis. On comparing our study with studies done by Devi J [40], Agarwal P et al [41] , De Silva RD et al [42], Prabhakarro P[43] and Misra P [44] showed a concordance rate of 96.2 %, 94.2% ,93.3 %, 90.7% and 90.6% respectively which is slightly higher then our study.

Table: 23 Correlation of frozen section diagnosis with final histopathological diagnosis

Study done by	Concordance rate	Discordance rate
Devi J et al[40]	96.2	3.8
Agarwal P et al[41]	94.2	5.8
De Silva RD et al[42]	93.3	6.7
Prabhakarro P.[43]	90.7	9.3
Misra P [44]	90.6	9.4
Present study	89.0	10.5

System wise distribution of Frozen section

In our present study, 52 cases [28.4%] of sentinel lymph nodes were received in cases of carcinoma breast, 47 cases [25.7%] were from female genital tract, 43 cases [23.4%] were from gastrointestinal tract, 28 cases [15.4%] were from head and neck, 7 cases [3.9%] were from urinary tract and 6 cases [3.2%] from skin were received for frozen section analysis. A study done by Adhikari P [45] done in 2018 showed that the maximum number of cases were from gynecology constituting 41% and least were from parotid and urinary bladder constituting 2 % each. A study done by Mohamed A[46] received maximum cases from head and neck region and least from breast.

Head and neck Region

In our present study we received 28 cases from head and neck region out of which 9 cases [32.1%] were of parathyroid gland and tongue biopsy each, 6 cases [21.4%] from brain and 1 case each were of parotid gland, eyelid lesion, buccal mucosa and thyroid gland. Concordance rate in head and neck region was 89.2% and discordance rate was 10.8 %. False positive cases were none. However, false negative cases were 3 (4.3%) with 1 case each from brain, buccal mucosa and eyelid lesion. In a study done by Kenneth A [47] authors found an overall reliability of 96% with total percentage of false positive and false negative being 0.35% and 3% respectively which is comparable to our study.

We received a total of 6 cases from brain for frozen section analysis out of which 5 cases were concordant and 1 case was discordant with the final histopathological diagnosis. The concordance rate is 83.3% and discordance rate is 16.7% in our present study. Among the 5 concordant cases, 3 cases showed a malignant neoplasm, 1 case showed fungal granuloma and 1 case showed necrosis only on frozen section. Among the 3 cases which showed a malignant neoplasm we were able to subclassify 1 case as Astrocytoma because of the presence of tumor against a fibrillary background however in other 2 cases we were not able to classify beyond a malignant neoplasm,

which is attributed to the technical poor preparation caused by freezing and drying artifacts. All these 5 cases showed similar findings on final histopathological examination. A study done by Mohammad A[46] had a concordance rate of 98.9%. The discordant case on frozen section showed necrosis only and permanent sections of the tissue sent later showed glioblastoma multiforme. The main reason for discrepancy in this case was regarded as sampling error by the surgeon as on processing the remaining tissue sent for frozen section by the surgeon also showed necrosis only. In the study conducted by Plesec TP et al [48] who evaluated 2,156 CNS cases and had 2.7% discrepant diagnoses, of which 14.0% involved errors in differentiating reactive from neoplastic processes. Another study done by Regragui A et al [49] assessed 1,315 cases and the rate of precise histologic compatibility was reported at 87.6% which is comparable to our present study. Comparing the present study with a study done by Nassif M[50] it also concluded that sampling error by surgeon as the main cause for discrepant frozen sections of brain.

Frozen section of buccal mucosa done for the primary diagnosis on frozen section showed no tumor. However, on processing the hemimandibulectomy specimen showed squamous cell carcinoma. The discordance was due to the sampling error by the surgeon as on processing the remaining tissue sent for frozen section by the surgeon also showed no tumor. A study done by Miyawaki A[51] studied the usefulness of frozen section in primary diagnosis of the tumor in buccal mucosa and suggested that it is a good modality. In our study we conclude that frozen section in buccal mucosa can be useful only if sampling is adequate.

Frozen section of eyelid lesion done for primary diagnosis of the case showed no tumor, however on processing the complete resection specimen showed presence of basal cell carcinoma. The discordance in our study was due to the sampling error by surgeon as on processing the remaining tissue sent for frozen section by the surgeon also showed no tumor. Usually the frozen section for eyelid lesion is

sent for knowing the resected margin status. It is a less used modality for knowing the primary diagnosis of the case . A study done by Chevez Barrios P et al [52] studied the indications and diagnosis of frozen section in ophthalmic pathology in which the majority cases were of eyelid lesion which were sent to know the resected margin status. Therefore we conclude that frozen section is not a good modality to know the primary diagnosis in eyelid lesions.

All the frozen section sent of Pararthyroid gland, Tongue biopsy, Parotid gland, Thyroid gland were concordant with the final histopathological diagnosis in our study. This is in corcordance with the studies done by Anton RC et al [53] who said that the frozen section evaluation of thyroid and parathyroid lesions remains a highly accurate procedure with a low false-positive rate. Study done by Chaturvedi P et al [54] showed that frozen section was found to have very high accuracy in assessment of margin and nodal status in cases of carcinoma tongue. Study done by Mantsopoulos K et al [55] showed that overall accuracy of frozen section in parotid gland tumors was 97.6%, sensitivity for malignancy was 91.1%, specificity was 100%, PPV was 100%, and the NPV was 96.8% which is similar to our study.

Female genital tract

In our study we received a request of frozen section for 47 cases from female genital tract system comprising of 31 cases [65.9%] from ovary, 9 cases [19.2%] from endometrium, 6 cases from cervix and 1 case of retained products of gestation. Overall concordance rate of frozen section in female genital tract is 85.1% and discordance rate is 14.9% in our present study which is in comparison to a study done by Khan AH et al [56] who studied 54 patients that underwent frozen section from the female genital tract which showed that the frozen section was accurate in 92.6%. In their study it had a moderately high sensitivity of 75%, high specificity of 97.6%, high positive predictive value of 90% and high negative predictive value of 93.2%.

Frozen section of all the 31 cases of **ovary** were sent for primary diagnosis of the cases in present study. In 27 cases we received oophorectomy specimens and in 4 cases we received small specimen. Clinical diagnosis was available in all the cases and carcinoma ovary was suspected in all these cases. Out of all 31 cases, 25 cases were concordant [80.6%] and 6 cases [19.4%] were discordant with the final histopathological diagnosis.

Among the 25 concordant cases, on frozen section 5 cases showed presence of a malignant neoplasm and we could not subclassify the tumor further. 2 cases showed a papillary epithelial neoplasm , 2 cases showed mucinous neoplasm, 3 cases showed a benign cystic lesion, 6 cases showed ovarian stroma only and 7 cases showed features of endometriosis. A study done by Khan AH et al [56] showed that the accuracy rate of diagnosing benign and malignant conditions was higher as compared to the borderline tumors. The non neoplastic conditions in their study included luteal cyst and endometriosis which were concordant with final histopathological diagnosis and is similar to our present study.

Amongst the discordant cases in present study, 2 cases were reported as malignant epithelial neoplasm which turned out to be adult granulosa cell tumor on final histopathology. This is attributed to the freezing artifacts arising in frozen section technique therefore masking the nuclear details of the cells due to which we were not able to discern the exact morphology of the cells and hence we missed the nuclear grooves. In 1 case on frozen section we reported it as borderline serous tumor which on final histopathology turned out to serous cystadenofibroma this is due to the interpretation error as the section for frozen section showed complex features which on examining the whole tissue showed a transversely cut papilla and the tumor was constituting < 10% of the total volume and similar problem was faced in a study done by Pinto PB et al [57] who studied 243 frozen section from the ovary and observed that the most frequent problem arises with the diagnosis of borderline and granulosa cell tumor.

One case in our study showed presence of extensive areas of necrosis only on frozen section which on final histopathology turned out to be a non seminomatous germ cell tumor In this case discordance is attributed to the sampling error by the surgeon, as on processing the remaining tissue sent for frozen section by the surgeon also showed no tumor. A study done by Akbarzadeh-Jahromi M [58] also faced a similar problem and stated that the sensitivity of malignant tumors of germ cell types was 64.3% and frozen section does not seem to be a precise technique for histopathologic diagnosis of ovarian tumors and among these malignant germ cell tumors had the lowest sensitivity.

Another case was reported as atypical squamous metaplasia on frozen section which on final histopathology was diagnosed as endometrioid carcinoma. The reason for discordance was due the small sampling size in which the squamous morules of the endometrioid carcinoma was mistaken for atypical squamous metaplasia and a study done by Buza N[59] also encountered diagnostic problems during intraoperative frozen section evaluation of mucinous, serous, endometrioid, and clear cell ovarian tumors which is similar to us.

Last discordant case in ovary was reported on frozen section as benign cystic lesion as it showed a flattened epithelium lining the cyst wall, However on assessing the final histopathology it showed Brenner's tumor. This discordance is due to small sample size and sampling error by the surgeon. A study done by Hashmi AA et al [60] unlike the present study showed that they were able to diagnose Brenner's tumor on frozen section and they found a high sensitivity and specificity of frozen section for the diagnosis of ovarian tumors and to determine its malignant potential. However, they also stated that under-diagnosis can occur in tumors of borderline category which can be minimized by increased sampling on the frozen section.

Frozen section received from cervix and retained products of conception were concordant with the final evaluation of the case which is in concordance with a study done by Rouzier R et al [61] who studied

310 cases of cervical cone biopsy as frozen section and observed that the sensitivity, specificity, and positive and negative predictive values of frozen section were 91%, 100%, 100%, and 98%, respectively and thus frozen section examination was highly accurate.

In our present study we received 9 frozen section from the endometrium out of which 8 were concordant with the final histopathological diagnosis and 1 was discordant. The discordant case on frozen section was reported as endometrial hyperplasia without atypia which turned to be endometrioid carcinoma on final histopathology. The discordance is due to the small sample size and sampling error by the surgeon which was also seen in a study done by Attard Montalto S et al [62] who showed that 37 patients with atypical hyperplasia or suspicious curettings on preoperative curettage who had undergone intraoperative frozen section out of which 23 patients had invasive malignancy, which was confirmed in subsequent paraffin sections attributing to the small sample size.

Sentinel lymph nodes in cases of carcinoma breast

We received 52 cases of sentinel lymph nodes in diagnosed case of carcinoma breast out of which 46 cases were concordant [88.4%] and 6 cases [11.6%] were discordant with the final histopathological diagnosis. The 46 concordant cases included 29 cases which showed reactive hyperplasia and 17 cases which showed metastatic deposits in the lymph node. Among the 6 discordant cases 5 showed reactive hyperplasia on frozen section which on final histopathology turned out to be metastatic carcinomatous deposits and 1 case was reported as suspicious of malignancy which turned out to be reactive hyperplasia on final histopathology. The reason for false positive case was interpretation error and the false negative cases were due to the sampling error by the pathologist as on processing the remaining tissue sent by the surgeon showed metastatic deposits. Similar findings were seen in a study done by Lombardi A et al [63] in which they studied a total of 1226 patients who underwent FS; among these patients 11.9% were false negatives. The global sensitivity of FS in detecting both

macro and micrometastases was 53.7% and FS has a low sensitivity in detecting micrometastases (19%) . Another study done by Barakat FH et al [64] studied 449 cases with no false positive cases on FS (specificity of 100 %) and the overall sensitivity was 84 % with a total accuracy rate of 93 % and interpretation sensitivity of 96 %. A similar study done by Poling JS et al [65] on 1940 cases in which 23.8% cases were false negative as the SLNB was called negative on frozen but positive on final examination. The majority of missed metastases were isolated tumor cells or micrometastases.

Skin

All 6 cases were sent to know the resected margin status in diagnosed cases of basal cell carcinoma. All the cases were concordant with final histopathology report. A study done by Megan J et al [66] studied that frozen sections play a vital role in the evaluation of margins of basal cell carcinomas and squamous cell carcinomas as FS examination is accurate in evaluating margins for BCC in approximately 90% to 95% of cases which is alike our study with 100% concordance rate.

Urinary tract

We received a total of 7 cases out of which 5 cases [71.4%] of frozen section were sent to see the resected margin status in case of carcinoma urinary bladder and 2 cases [28.6%] were to look for metastasis in lymph node in case of carcinoma penis. All 7 cases were concordant with final histopathological findings. A study done by Soliman K et al [67] showed involvement of the ureteric margins in 2-9% at radical cystectomy. The sensitivity and specificity of FS were ~75% and 99%, respectively which is much lower as compared to our study in which the sensitivity and specificity was 100% each respectively.

Gastrointestinal tract

We received a total of 43 cases [23.4%] from gastrointestinal tract, out of which 14 cases [32.5%] each were of gall bladder and pancreas followed by 5 cases [9.3%] of peritoneum, 4 cases [9.4%] of appendix, 3 cases [6.9%] of rectum, 2 cases [4.7%] of esopagus and least

number of cases were from duodenum that is 1 in number. A study done by Tangde A. [22] studied 83 cases out of which 10.8% cases were from gastrointestinal tract which comprised of 4 cases from rectum, 2 cases each from colon and stomach and one case from liver.

Among the 43 cases from gastrointestinal tract a request for frozen section in 2 cases were received from the esophagus to look for metastasis in the nodular deposits. Both the cases were concordant with the final histopathological findings. A study done by Hagihara T[68] showed an accuracy and false negative rates of 100% and 0% respectively which are in concordance with our study.

We received one case of duodenal mass for primary diagnosis for which we received a segment of intestine. On frozen section it was reported as epithelial neoplasm which was concordant with the final histopathological findings. A study done by Gao Y et al [69] showed a sensitivity of 100% in pTis tumor which is similar to our present study.

5 peritoneal biopsies were received to look for metastasis in diagnosed cases of various carcinomas. Out of the 5 cases, 3 cases were reported as suspicious for malignancy and 2 cases were reported as carcinoma on frozen section. Among the 5 cases 1 case was discordant and 4 cases were concordant with final histopathological diagnosis. The 1 discordant case on frozen section was reported as suspicious of malignancy however, on final histopathology it was free of tumor. A study done by Mohamed A[46] showed a concordance rate of 96.8% and discordance rate of 3.2% in peritoneal biopsies. The discordant case is attributed to the freezing artifacts which causes cell enlargement and smudginess of the chromatin.

We received a total of 14 cases out of which 9 cases (64.4%) were for primary diagnosis for which we received cholecystectomy specimen, 3 cases (21.4%) were to know the resected margin status for which we received bile duct margin and 2 cases (14.2%) were to look for metastasis for which we received nodular deposit over liver. Out of the 14 cases of gall bladder, 1 case was malignant, 2 cases were

suspicious of malignancy, 10 cases showed normal tissue and 1 case was deferred. Out of the 14 cases, 12 cases were concordant and 1 case was discordant with the final histopathological diagnosis and 1 case was deferred. One discordant case on frozen section was reported as suspicious of malignancy but on final histopathological diagnosis was reported as chronic cholecystitis. Concordance rate in our present study is 85.7%. A study done by Lechago J et al [70] showed concurrence in more than 95% of the cases. Another study done by Yamaguchi K et al [71] showed an overall concordance rate among 86 cases of gall bladder of 95.3%. Study done by Aoki T [72] studied 983 cases of gall bladder which had a sensitivity of 64% and specificity to be 100%.

One case that was deferred was of a 73 year old male with a clinical diagnosis of carcinoma gall bladder. We had received cholecystectomy specimen for primary diagnosis. The cell morphology was not clearly discernible. The cells appeared crushed and had hyperchromatic nuclei with moderate amount of cytoplasm with few glands exhibiting nuclear hyperchromasia and nuclear stratification. It was difficult to ascertain whether these were reactive changes or neoplastic hence was deferred for diagnosis. A study done by Zhang SM et al [73] showed a deferred and discordance rate of 2.57% and 2.2% respectively and the most common cause of deferred and discordant was poor section quality which is similar to our study.

We received 4 cases of frozen section from appendix which were sent for primary diagnosis of the cases. 3 cases (75%) showed no tumor and 1 case was reported as presence of extracellular mucin only. The 3 cases on frozen section which showed no tumor showed presence of thickened wall with acute and chronic inflammatory cells. Out of 4 cases, 2 cases were concordant and 2 cases were discordant with final histopathological diagnosis**.** Out of the 2 discordant cases 1 case on frozen section showed thickened wall with acute and chronic inflammatory cells and other case showed presence of only extracellular mucin, however on final histopathological diagnosis both

the cases showed presence of low grade mucinous appendiceal neoplasm. The discordance was regarded because of the sampling error of the pathologist. A study done by Yoshida H et al [74] had misdiagnosed 4 cases of low grade appendiceal mucinous neoplasm as ovarian neoplasms and hence proposing correct grossing methods to reduce sampling error. Another study done by Panarelli CN et al [75] studied that frozen section analysis may be requested to assess the status of the appendiceal margin, determine whether extra-appendiceal epithelium is present, and to classify extra-appendiceal disease as low- or high-grade and they also stated that the classification of appendiceal tumor is both challenging and controversial.

A total of 3 cases of rectum were received, out of which 2 cases [66.7%] were sent to know the resected margin status in diagnosed case of carcinoma rectum and one case [33.3%] was received for primary diagnosis. On frozen section, 2 cases (66.7%) showed no tumor and were concordant with the final histopathological diagnosis and 1 case (33.3%) reported as villous adenoma with dysplasia was discordant with final histopathological diagnosis. The reason for discordance was superficial and small biopsy as no definite invasion was seen in the tissue sent for frozen section, However on processing the entire specimen we saw invasion upto the muscularis propria.

We received 14 cases of pancreas for frozen section out of which 11 cases (78.7%) were sent to know the resected margin status, 2 cases (14.2%) were sent to look for metastasis and one case for primary diagnosis of the case. All the cases were concordant with final histopathological diagnosis as they showed same findings. A study done by Cioc AM et al [76] studied 284 cases of pancreatic lesion and had a false positive and false negative result of 1.2% and 0.3% respectively. They also concluded that the frozen section of resected margin status was 100% accurate and 98.3% accurate for pancreatic lesions and metastatic deposits.

Overall False positive rate and false negative rate of frozen section in our present study is 6.6% and 14.4% respectively. In a study done by De Silva RD [42] showed a false negative rate of 2.08% and false positive rate of 0%, Winther C [77] showed a false negative rate of 4 % and false positive rate of 0% which is not in concordance to our study.

The sensitivity, specificity and accuracy of our study was 80%, 96.2% and 89% respectively which is in comparison to a study done by Tangde A and Farah Klibi F and is lower then the study done by Chang JL, Shrestha S and Abbasi F.

Table 24: Comparison of Accuracy, Sensitivity and Specificity of various studies

Study done by	Study Period	No of cases	Accuracy	Sensitivity	Specificity
Tangde A[22]	1 year	83	91.5%	85.7%	97.9%
Chang JL et al [78]	1 year	1084	97.7%	96.1%	99.4%
Farah Klibi F et al[79]	3 year	1207	97.5%	84.6%	99.8%
Shrestha S et al [14]	5 year	404	94.6%	94.5%	94.5%
Abbasi F et al[80]	7 year	200	96.5%	93.1%	97.7%
Present Study	1 year	183	89%	80%	96.2%

On comparing the sensitivity, specificity, PPV, NPV, concordance rate, discordance rate were highest in diagnosis of resected margin status

followed by cases to look for metastasis and least in primary diagnosis in our present study therefore we conclude that the frozen section is the best modality to know the resected margin status followed by to look for metastasis and least preferred for knowing the primary diagnosis of the case.

Among the 19 discordant cases including the false positive and false negative cases the most common cause of discordance was sampling error from surgeon side followed by sampling error by the pathologist, freezing artifacts due the technique, and interpretation error. 8 cases [42.2%] were discordant due to the sampling error of the surgeon, 7 cases [36.8%] were due to the sampling error of the pathologist, 2 cases [10.5%] were due to the freezing artifacts and 2 cases [10.5%] were discordant due to the interpretation error by the pathologist which are in comparison to the study done by Adhikari P[45] who studied the various causes of discordant cases were most commonly due to sampling error, misinterpretation, lack of communication with the surgeons and technical problems. Another study done by Usubütün A [81] stated that lack of communication between the surgeon and the pathologist was the main reason for discordance.

So frozen section were found to be a quick and reliable method for evaluation of resected margins and metastasis in lymph nodes in the present study. We have to be careful while interpreting the frozen section because freezing of tissues leads to enlargement of cell and nuclear size with change in chromatin appearance which might be difficult to interpret. So while interpreting the frozen section we have to keep this in mind and avoid overdiagnosis of the case.

Evaluation of frozen section can help the surgeon to plan surgical procedure while the patient in on the operating table.

SUMMARY AND CONCLUSION

Frozen section is a modality used by the surgeon to know urgently about the lesion while the patient is on the operating table. Freezing tissue is a rapid method that can be used to harden tissue sufficiently to allow thin sectioning. The examination report of frozen section is conveyed as soon as possible to the operating surgeon via telephone or intercoms as the result will greatly influences the surgeon's intra-operational decision. The pathologist has to arrive at a correct decision in a shorter duration under pressure based on his experience, judgement and the knowledge of his speciality and clinical medicine. In this study we analysed 183 cases of frozen section and the findings are:

1. The commonest age group who underwent frozen section was between 41 to 50 years comprising of 52 cases [28.5%].
2. Frozen section was performed more for females constituting 146 cases [79.8%] with a male to female ratio of 1:3.9.
3. Out of the 183 cases, 85 cases [46.5%] were received for primary diagnosis, while in 64 cases [34.9%] it was done to look for metastasis and the remaining 34 cases [18.6%] were sent to assess the resected margin status.
4. The revert time in 78 cases [42.6%] was 21-30 minutes while in majority of cases that is in 91 cases [49.9%] the revert time was 31-40 minutes with a mean time of 36.3 minutes and the least amount of time taken was 26 minutes and maximum time taken was 55 minutes in 2 cases.
5. Among 183 cases, 111 cases [60.7%] were included in non-neoplastic category, while 71 cases [38.8%] were classified as neoplastic and in 1 case [0.5%] the diagnosis was deferred.
6. 163 cases [87.9%] were concordant, 19 cases [10.5%] were discordant with final histopathological diagnosis and 1 case was deferred.
7. 52 cases [28.4%] were of sentinel lymph nodes received in cases of carcinoma breast, 47 cases [25.7%] from female

genital tract, 43 cases [23.4%] from gastrointestinal tract, 28 cases [15.4%] from head and neck, 7 cases [3.9%] from urinary tract cases and 6 cases [3.2%] from skin were received for frozen section analysis.

8. In the neoplastic category maximum number of malignant neoplasm and metastatic carcinomatous deposits were reported in female genital tract followed by sentinel lymph nodes sent in carcinoma breast cases then head and neck and gastrointestinal tract subsequently.
9. In the non-neoplastic category, maximum cases of reactive lesions were reported in sentinel lymph nodes and highest number of normal tissue was reported in gastrointestinal tract.
10. The concordance rate was 100% for skin and urinary tract, 89.2% for head and neck, 88.4% for sentinel lymph nodes, 88.3% for gastrointestinal tract and 85.1% for female genital tract.
11. False positive cases were 4 in number with a false positive rate of 6.6% and false negative cases were 15 in number with a false negative rate of 14.4%.
12. Overall sensitivity, specificity, PPV, NPV of frozen section were 80%, 96.2%, 93.7% and 87.3%.
13. Sensitivity, specificity, PPV, NPV, concordance rate, discordance rate were highest in diagnosis of resected margin status and least in primary diagnosis.
14. Among the 19 discordant cases, 8 cases [42.2%] were discordant due to the sampling error of the surgeon, 7 cases [36.8%] were due to the sampling error of the pathologist and 2 cases each [10.5%] were due to the freezing artifacts and interpretation error by the pathologist.
15. After studying all the cases we also found that hematoxylin and eosin stain is better stain than toludine blue stain attributing to the difficulty that arises due to the enlargement of the cell and smudgy chromatin which poses difficulty in interpretation with toludine blue.

Thus from our study we conclude that frozen section is the best modality for knowing the resected margin status and is reliable and accurate for intraoperative evaluation of lymph nodes, and the primary diagnosis of most tumors.

Tumors with a large necrotic component and very small samples pose challenges in evaluation by frozen section due to high sampling errors and technical difficulty respectively.

Frozen section evaluation is an accurate mean of intraoperative diagnosis and its efficacy is validated at our centre.

Suggestions to improve accuracy and decrease discordance

1. Interdisciplinary communication to decrease sampling and interpretation errors.
2. Strict adherence to quality control measures and periodic audits.
3. Identifying the correct indication for performing frozen section.

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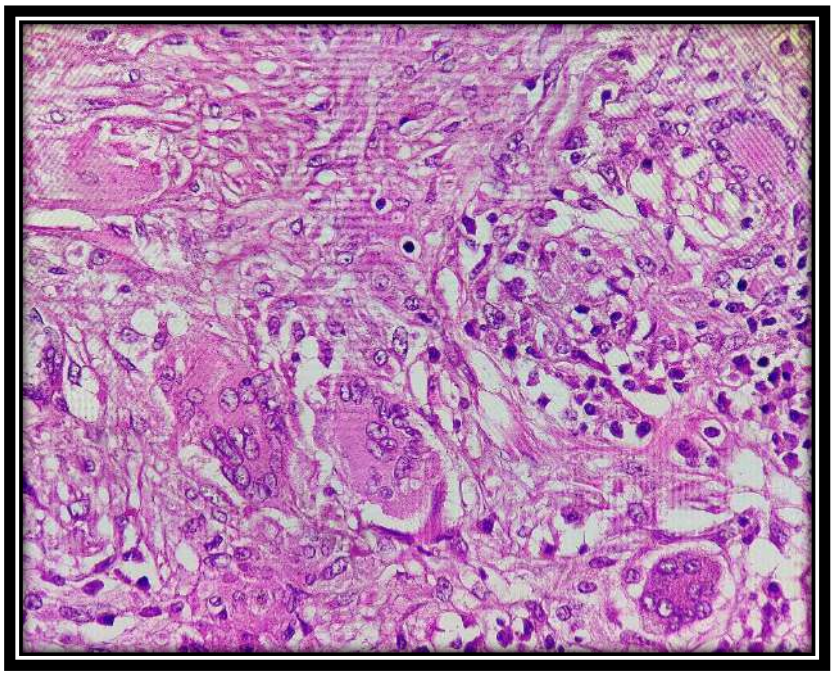
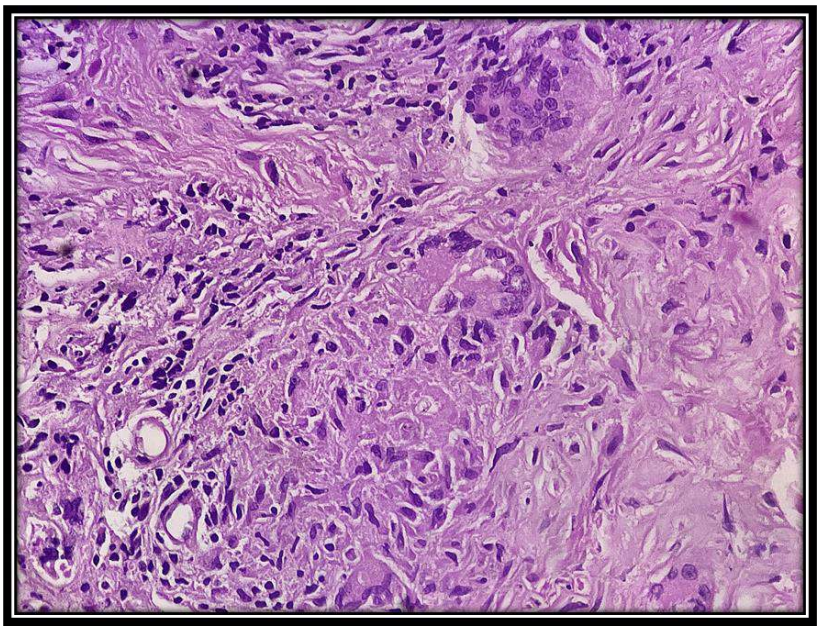
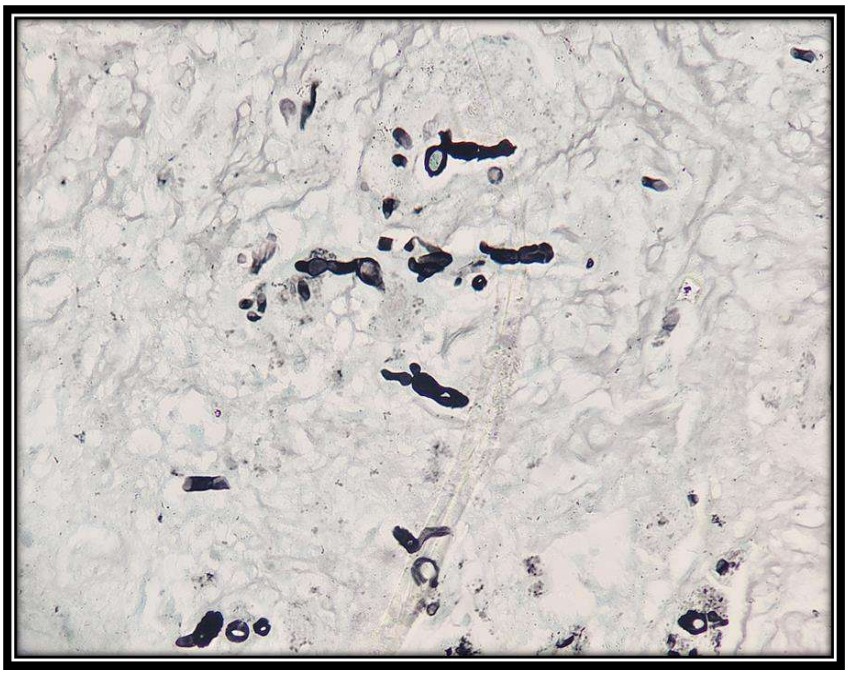


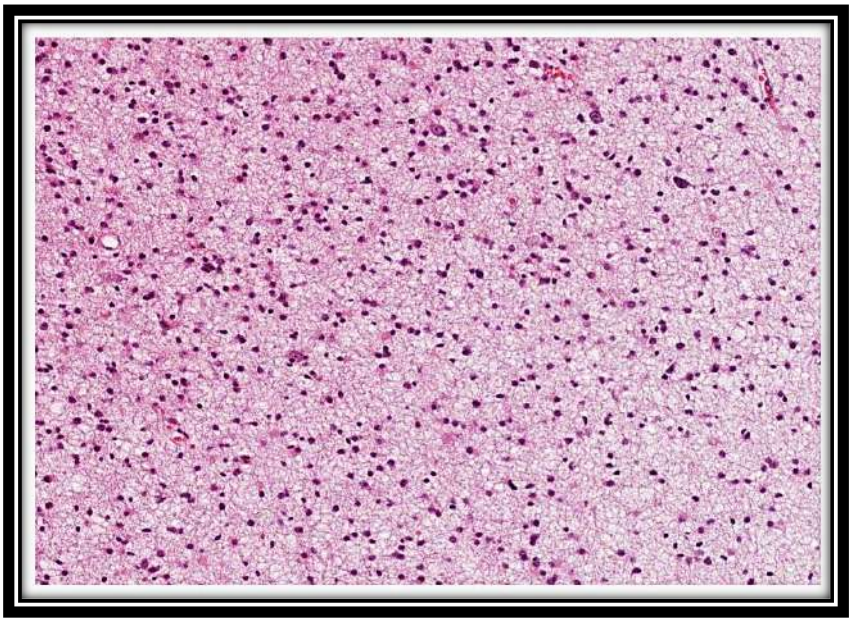
Picture 1- Frozen section of brain showing many foreign body multinucleated giant cells with negative shadows of fungus within the multinucleated giant cell (H&E,400X)



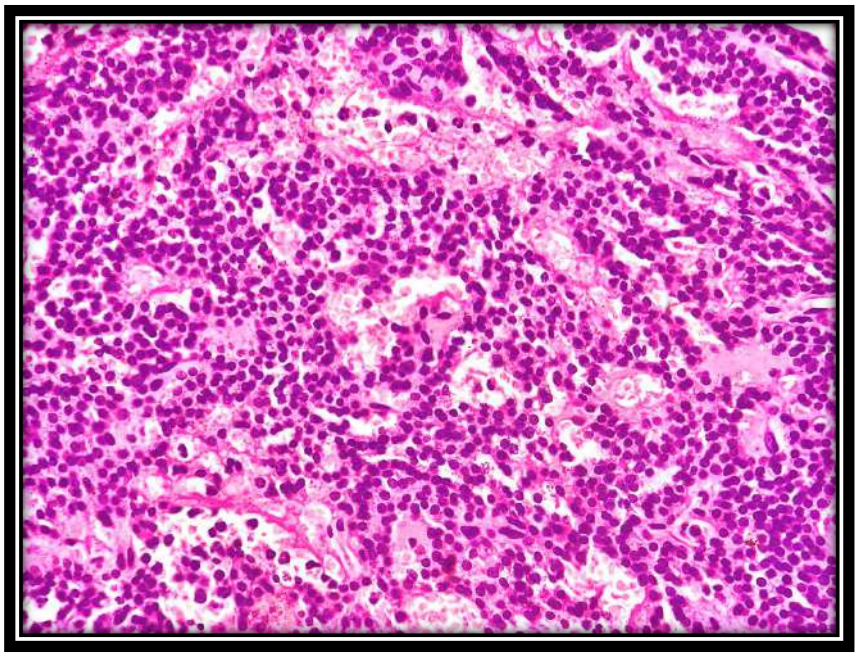
Picture 2– Final histopathology of brain showing many foreign body multinucleated giant cells with negative shadows of fungus within the multinucleated giant cell (H&E,400X)



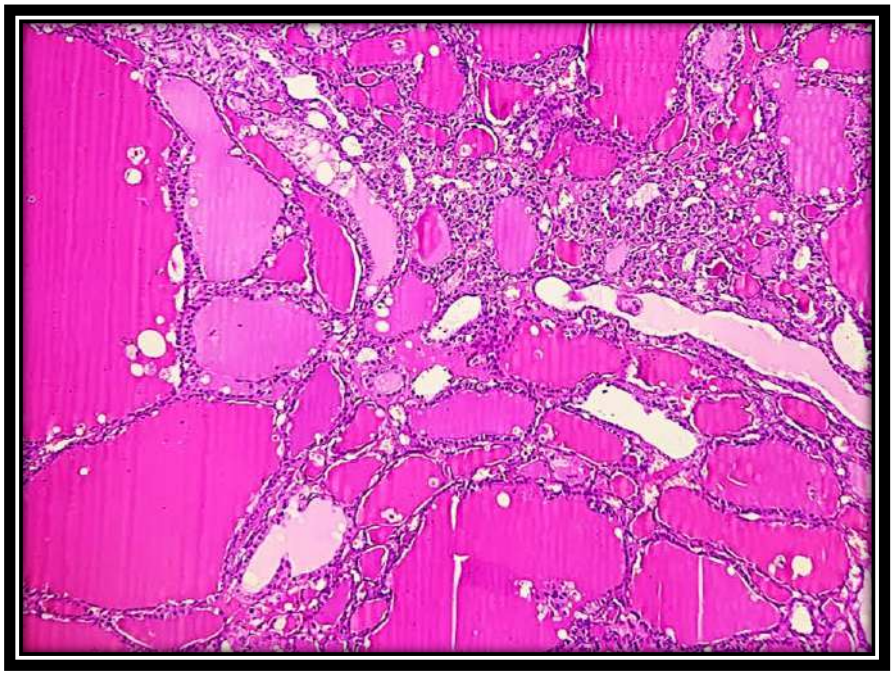
Picture 3 – Final histopathology of brain showing aspergillosis seen as septate acute angled branching fungal hyphae (GMS,400X)



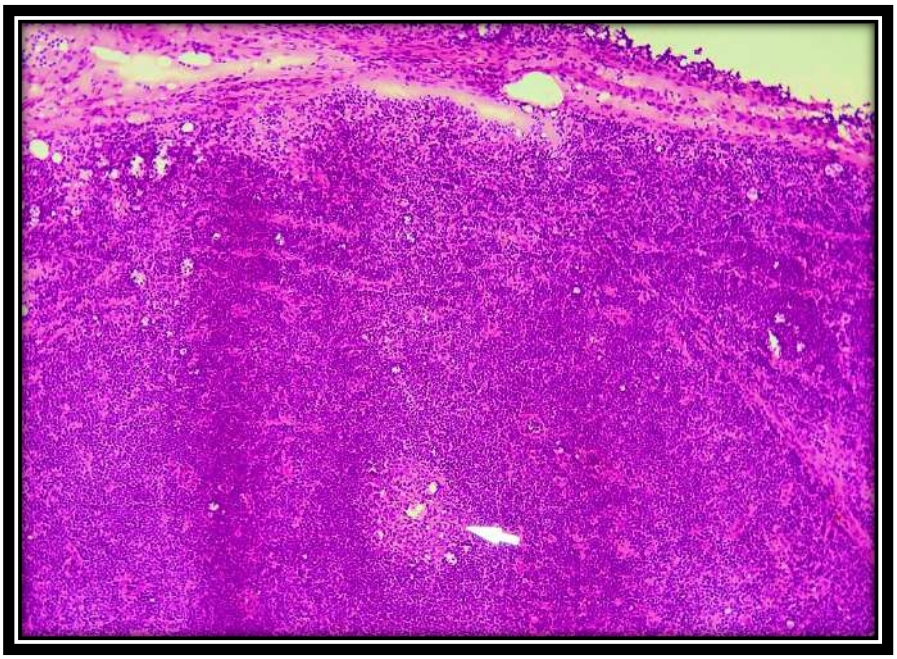
Picture-4 Frozen section of astrocytoma showing cellular tumor arranged in sheets against a fibrillary background (H&E,400X)



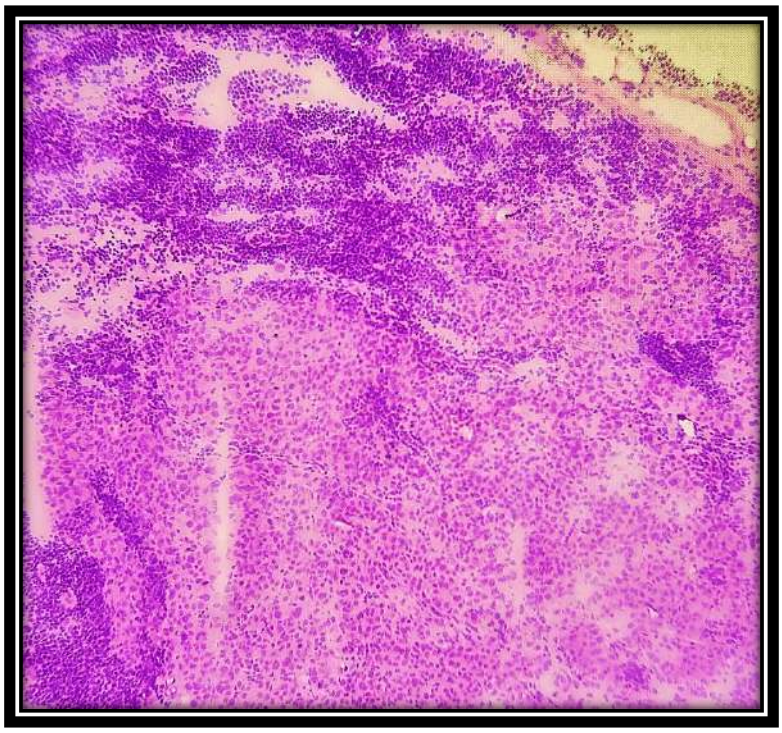
Picture 5 – Frozen section of parathyroid gland showing parathyroid adenoma with presence of chief cells (H&E,400X)



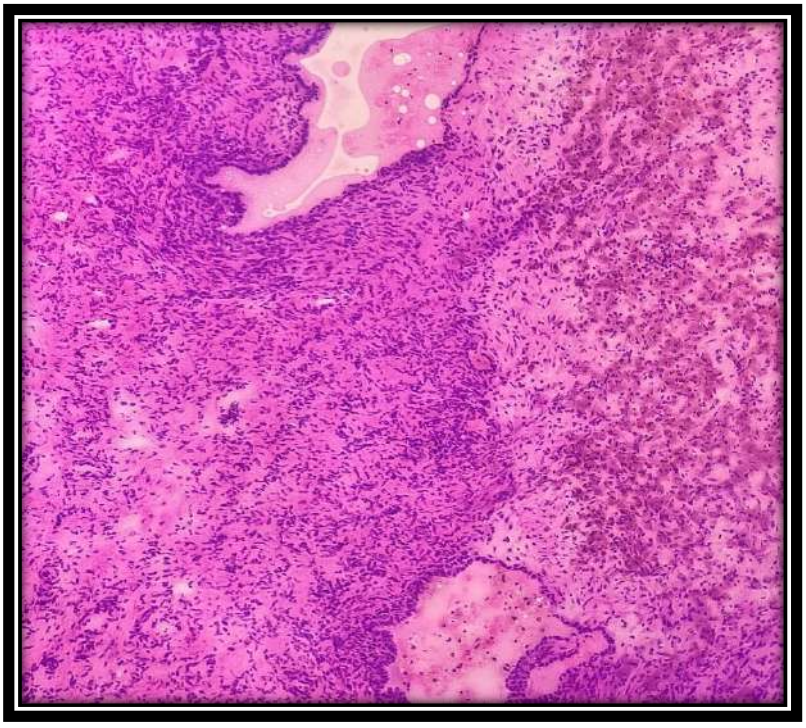
Picture 6 –Frozen section of thyroid gland showing multinodular goitre with variably sized follicles filled with colloid (H&E,100X)



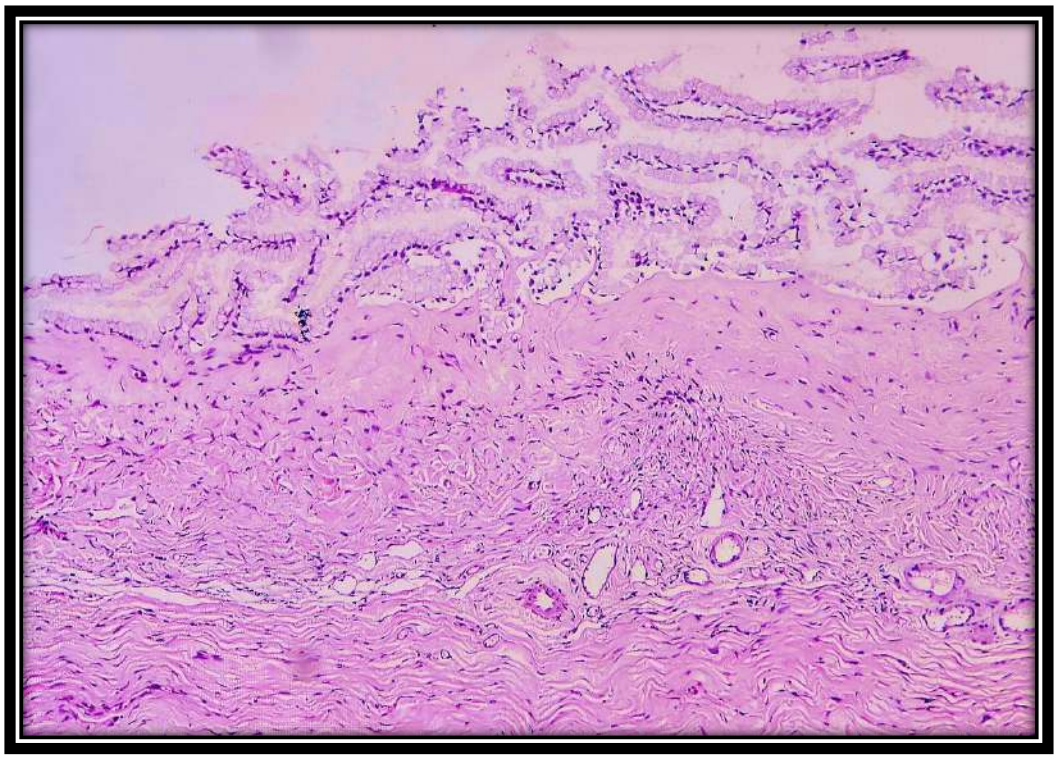
Picture 7 – Frozen section of reactive hyperplasia lymph node having lymphoid follicles with reactive germinal centres (H&E,100X)



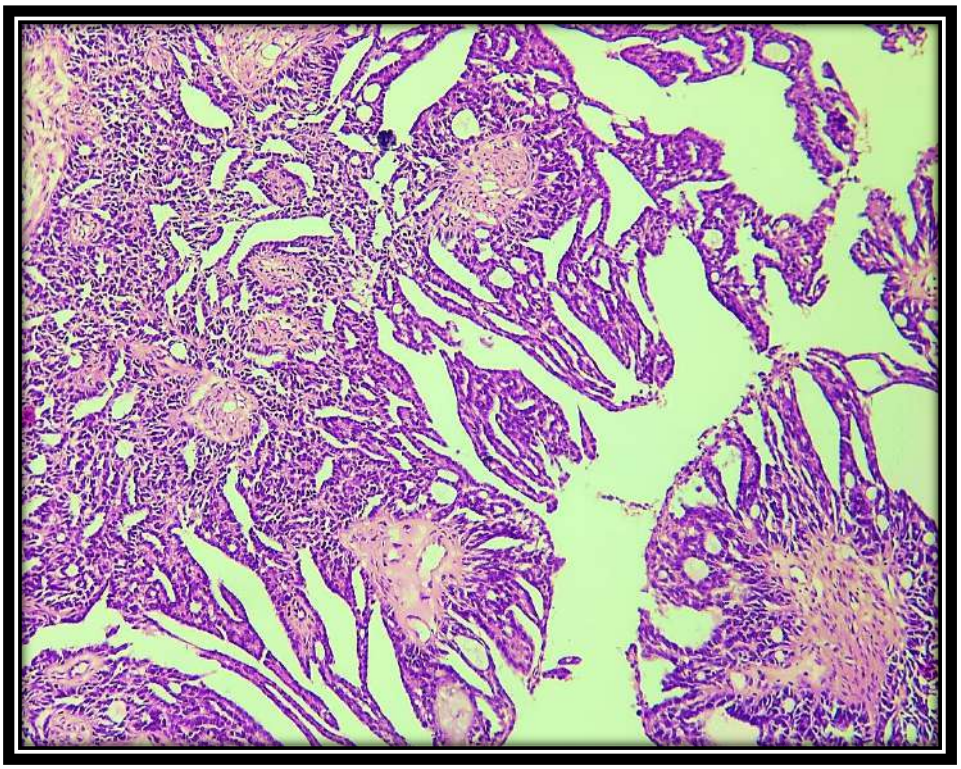
Picture 8 – Frozen section of lymph node showing metastatic carcinomatous deposits (H&E,400X)



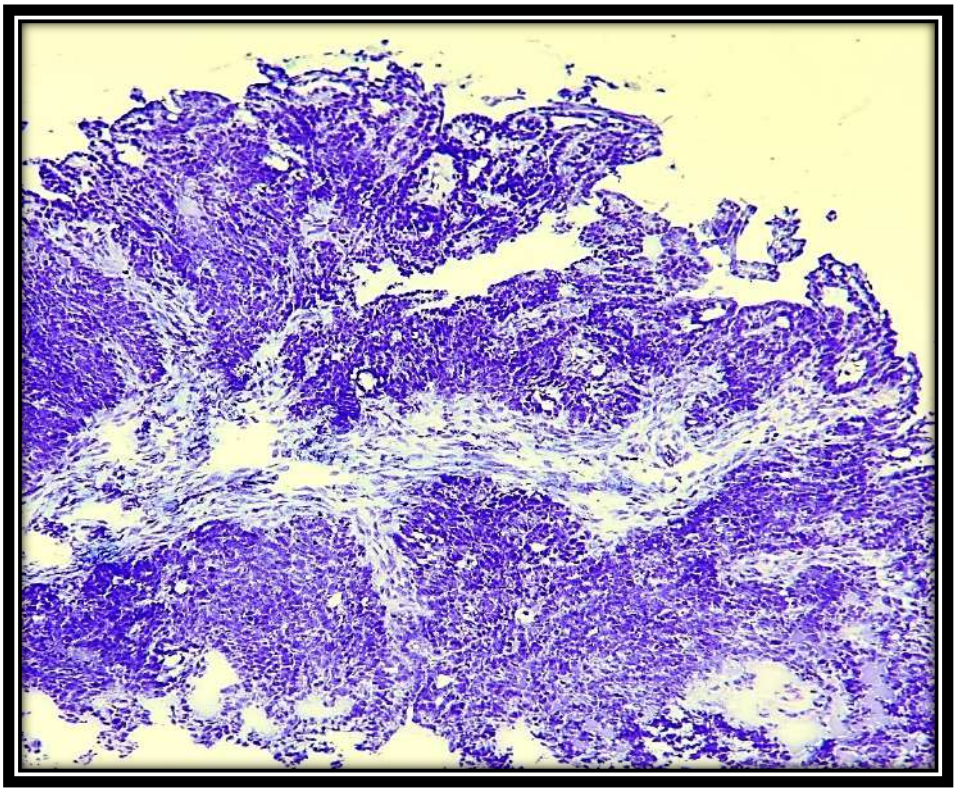
Picture 9 – Frozen section of ovary showing endometriosis with presence of endometrial glands and hemosiderin laden macrophages (H&E, 100X)



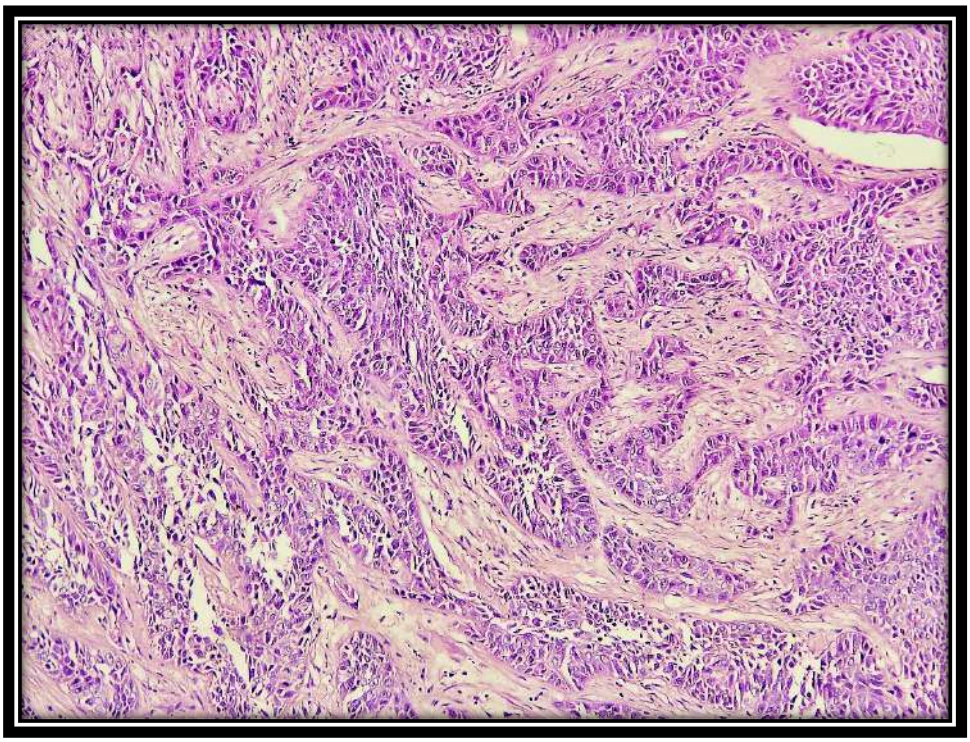
Picture 10- Frozen section of ovarian mass showing a mucinous neoplasm with proliferation of mucin secreting epithelium (H&E,100X)



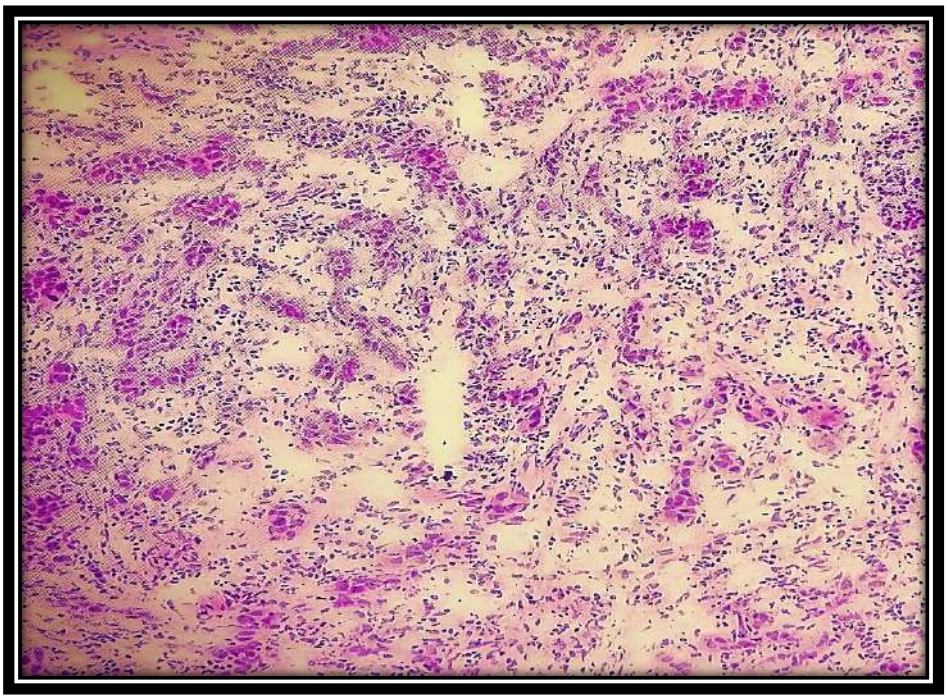
Picture 11- Frozen section of ovarian mass showing papillary epithelial neoplasm with presence of papillae lined by pleomorphic cells having hyperchromatic nuclei (H&E,100X)



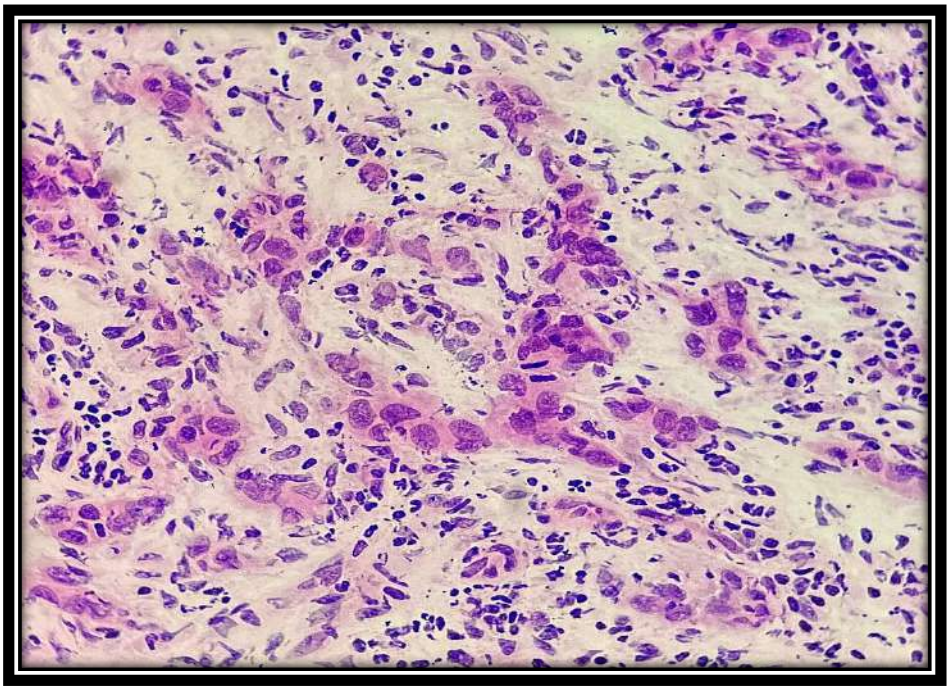
Picture 12- Frozen section of ovarian mass showing papillary epithelial neoplasm with presence of papillae lined by pleomorphic cells having hyperchromatic nuclei (Toludine Blue,100X)



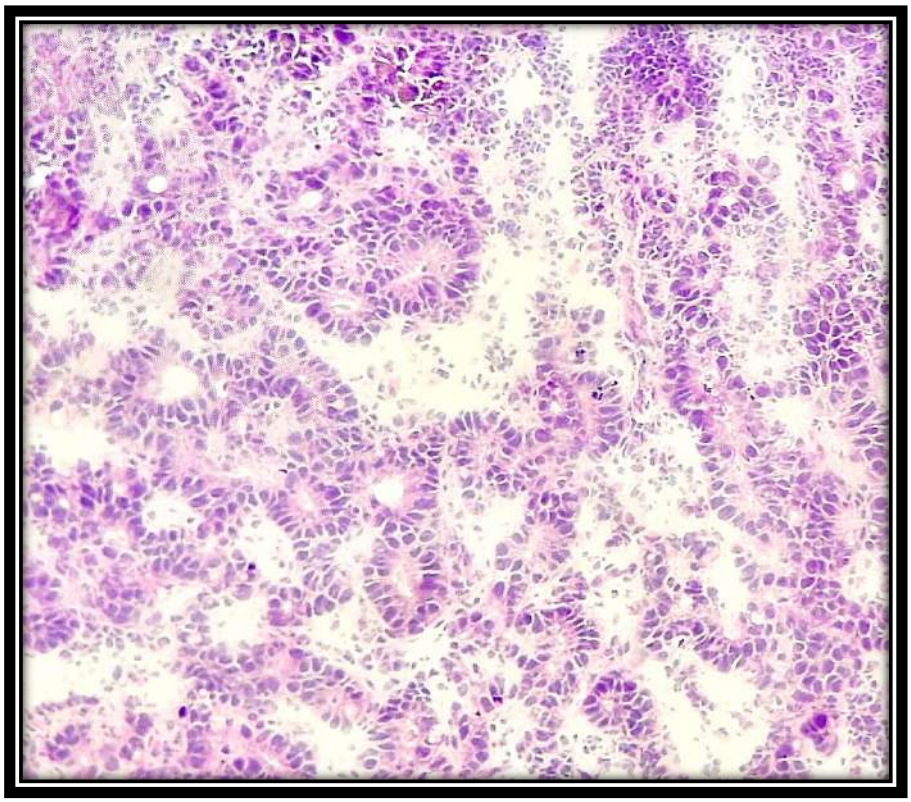
Picture 13 - Frozen section of cervix showing squamous cell carcinoma with cells arranged in nests and have hyperchromatic nuclei with moderate cytoplasm (H&E,400X)



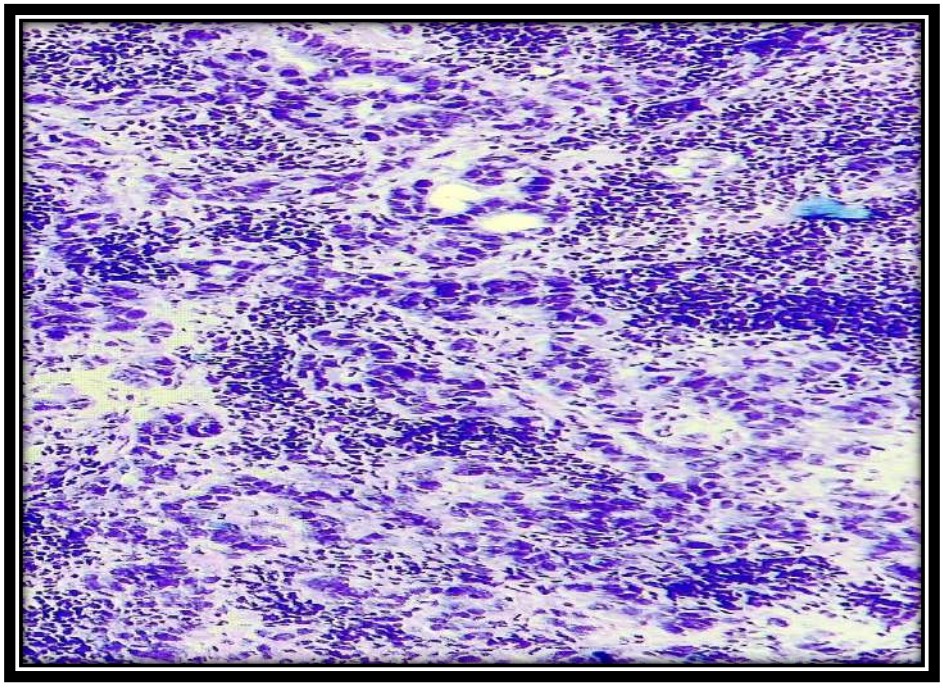
Picture 14 – Frozen section of gall bladder showing carcinoma with presence of tumor cells arranged in glandular configuration and nests (H&E, 100X)



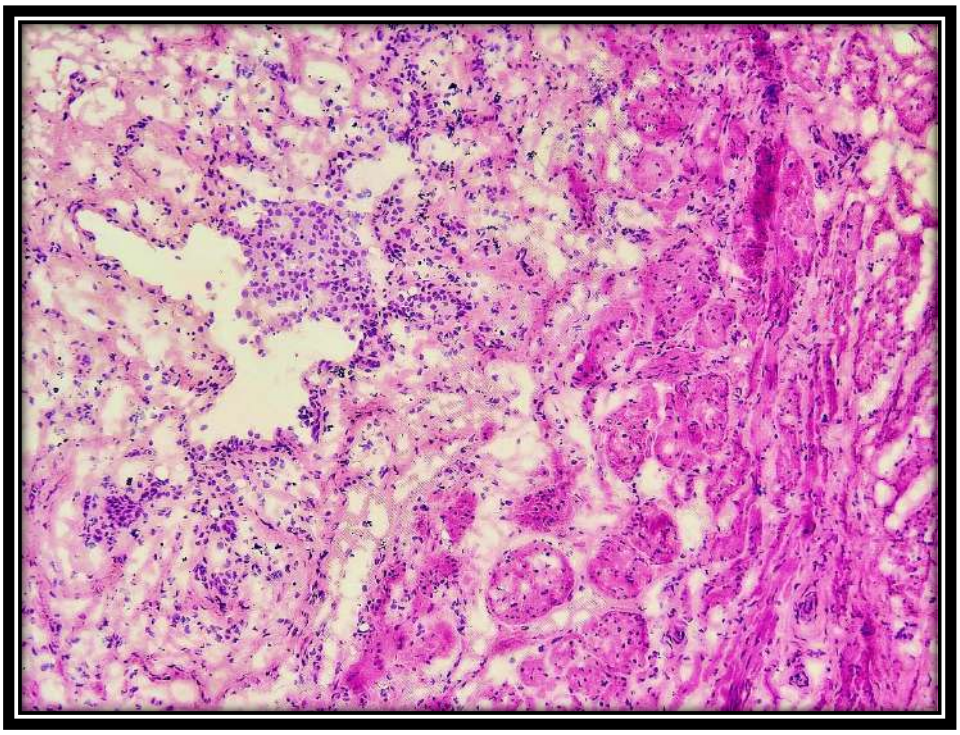
Picture 15 – Frozen section of gall bladder showing carcinoma with presence of tumor cells having pleomorphic cells (H&E,400X)



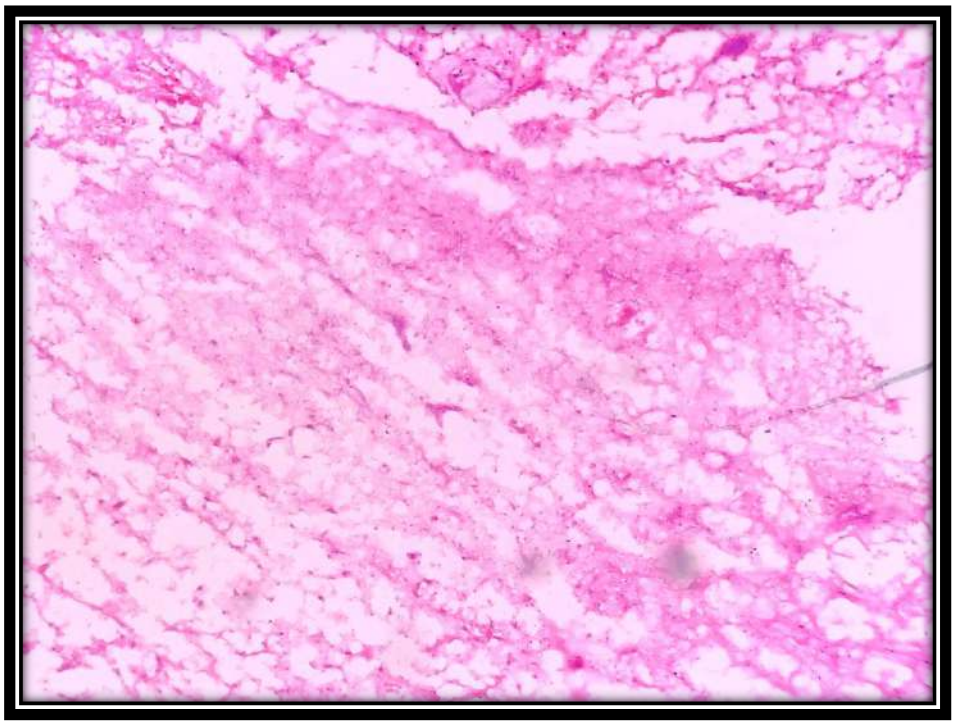
Picture 16 - Frozen section of peritoneal nodule showing metastatic adenocarcinomatous deposits (H&E,100X)



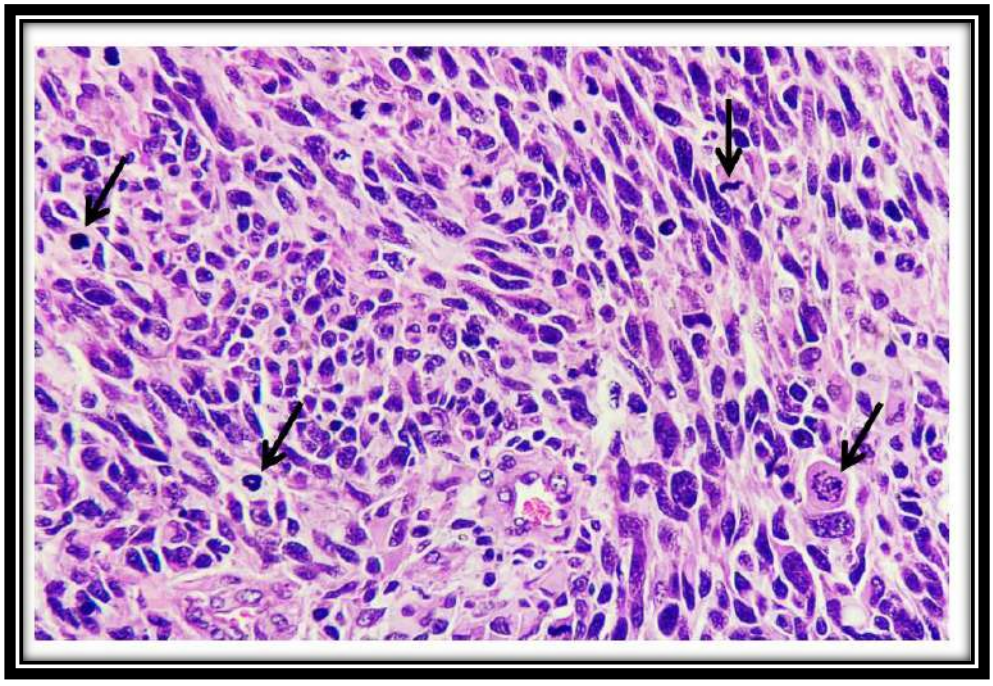
Picture 17 - Frozen section of peritoneal nodule showing metastatic adenocarcinomatous deposits (Toludine Blue,100X)



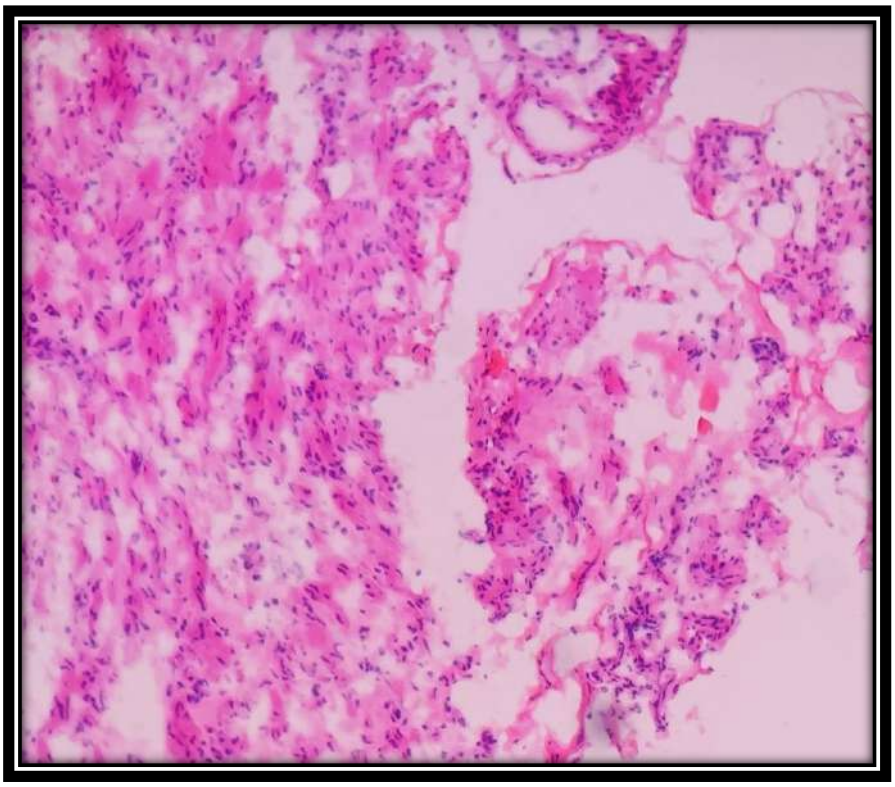
Picture 18– Frozen section of ureteric margin showing no tumor infiltration (H&E,100X)



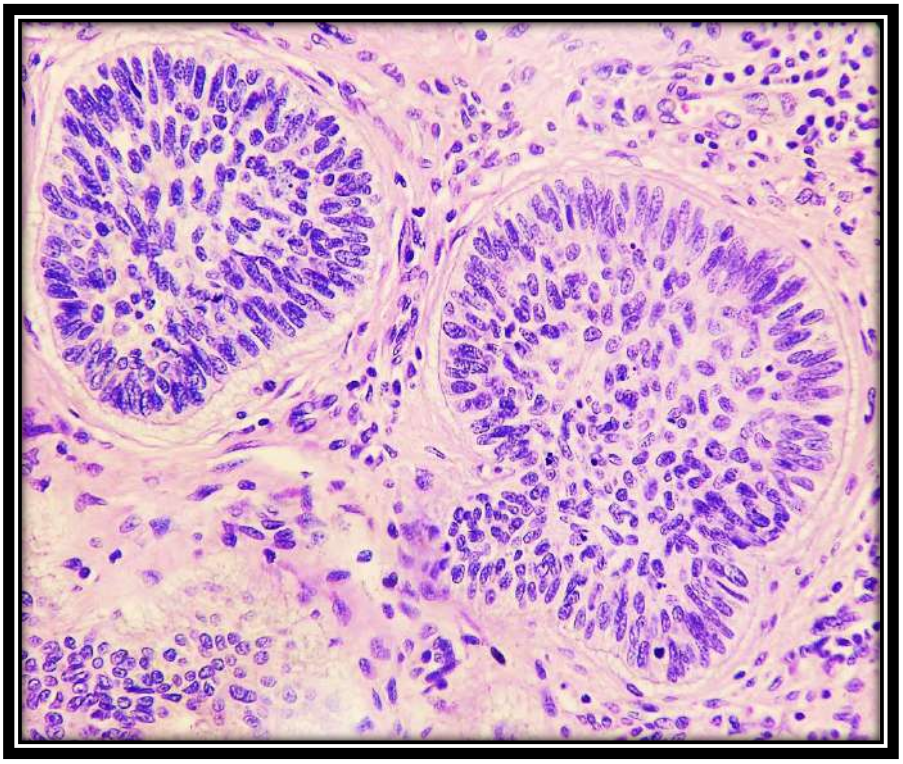
Picture 19– Frozen section of brain showing necrosis only (H&E, 400X)



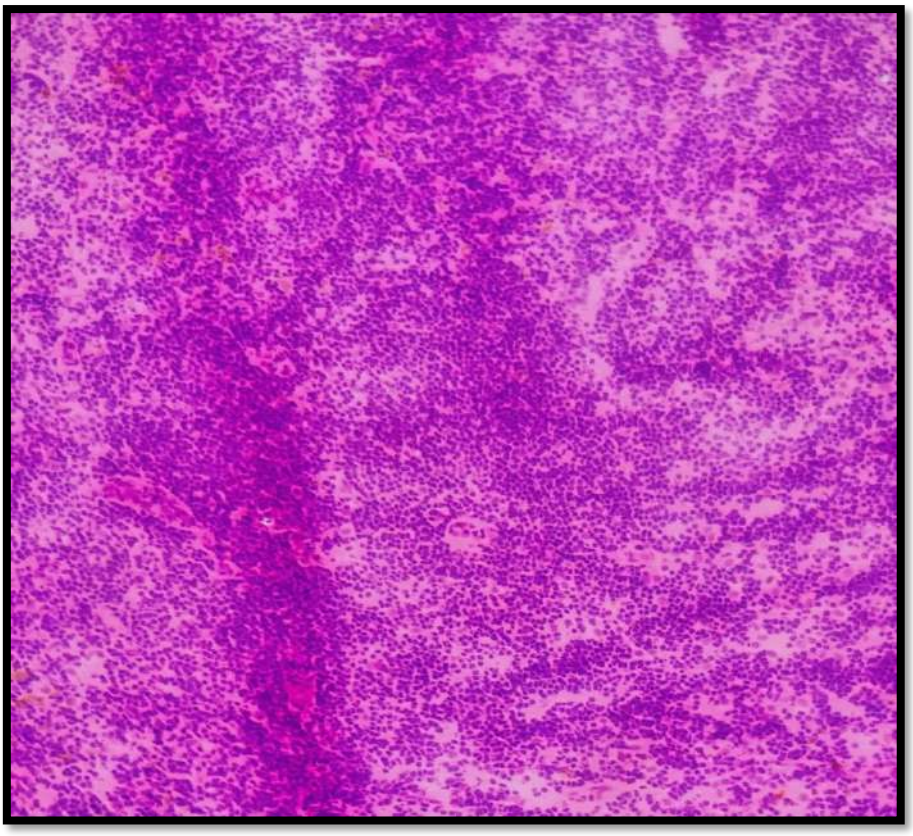
Picture 20 - Final histopathology showing glioblastoma multiforme with a cellular tumor exhibiting nuclear pleomorphism, hyperchromasia and brisk mitosis (H&E,400X)



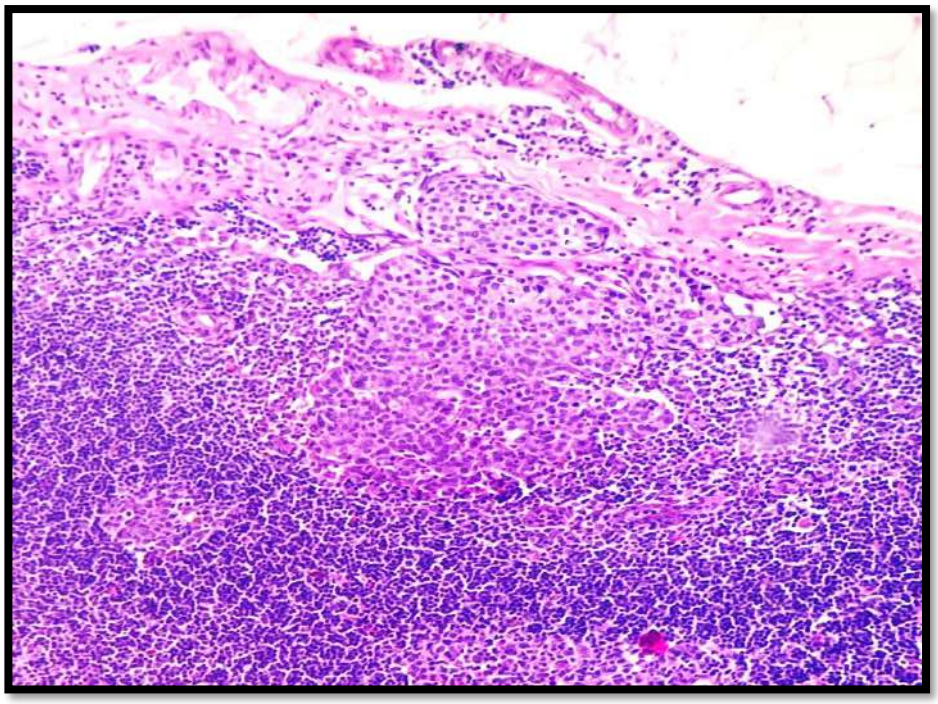
Picture 21 – Frozen section of eyelid lesion showing fibrofatty and fibrocollagenous tissue and no tumor (H&E, 400X)



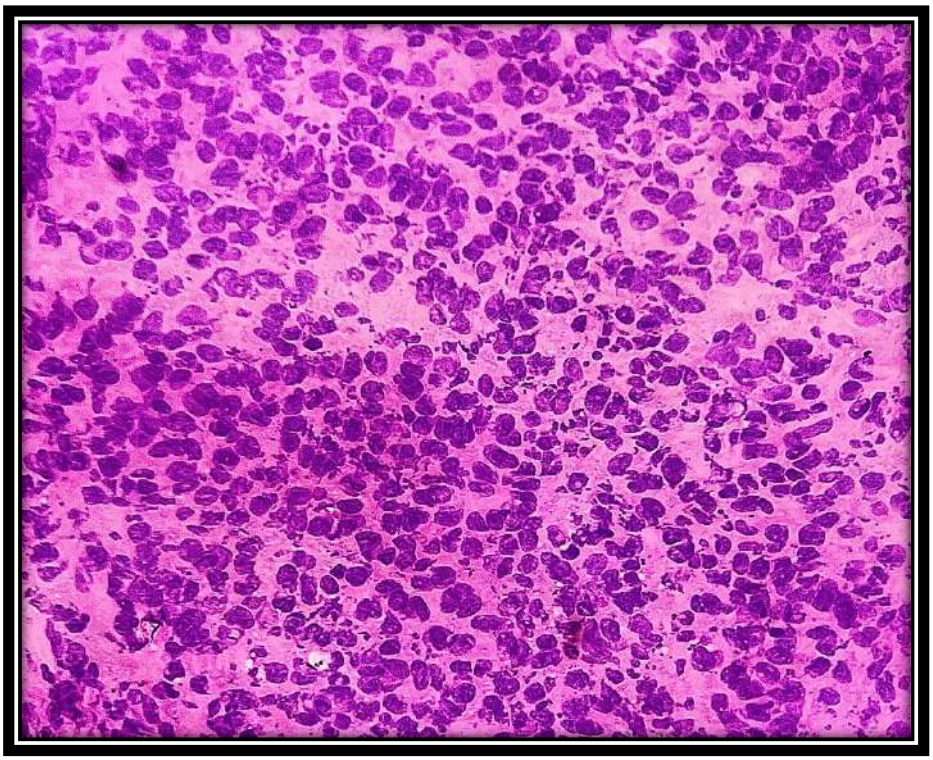
Picture 22 – Final histopathology of eyelid lesion showing basal cell carcinoma with cells exhibiting nuclear palisading (H&E, 400X)



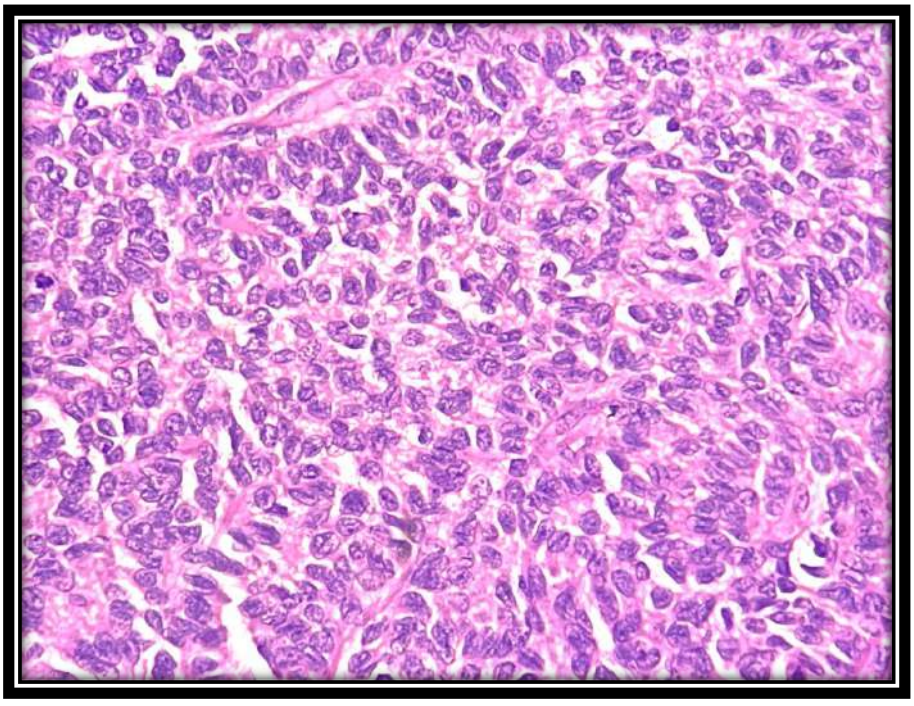
Picture 23- Frozen section of reactive hyperplasia lymph node (H&E, 100X)



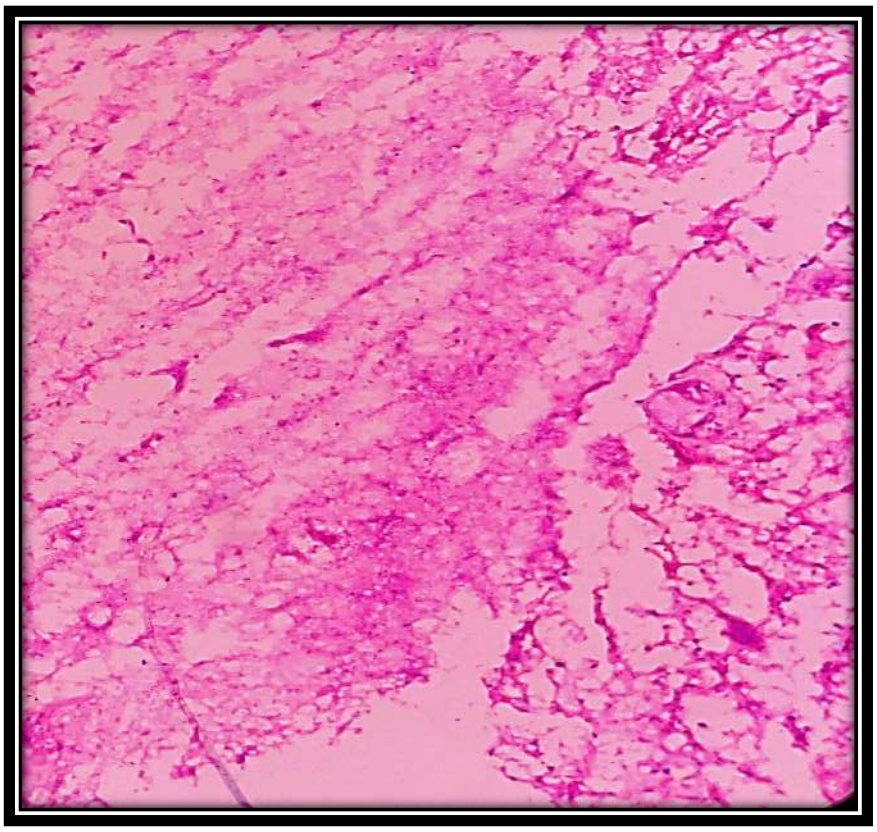
Picture 24 - Final histopathology of lymph node showing metastatic carcinomatous deposits. (H&E,100X)



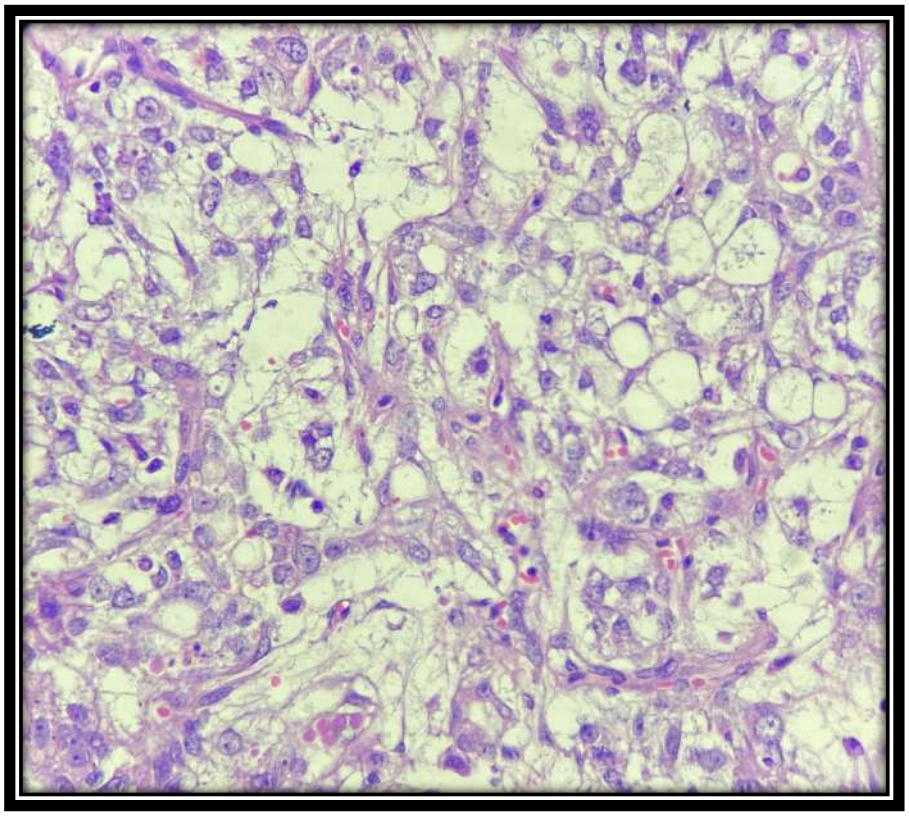
Picture 25– Frozen section of ovarian mass showing malignant epithelial neoplasm with presence of sheets of cells having hyperchromatic nuclei (H&E,400X)



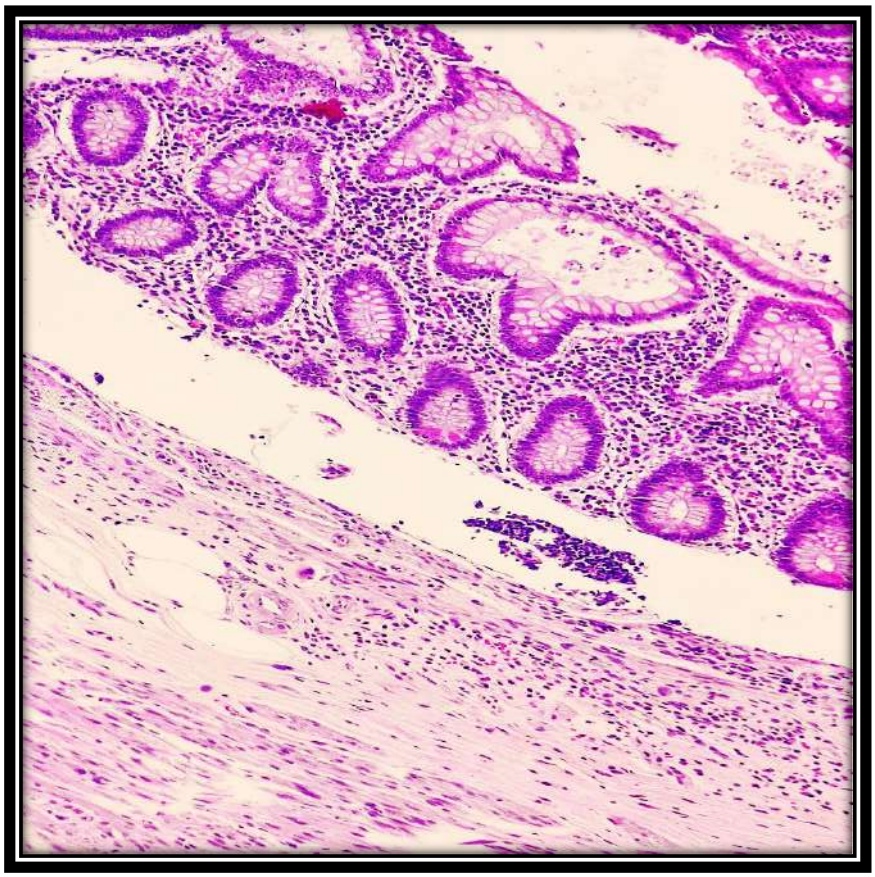
Picture 26 – Final Histopathology of ovarian mass showing adult granulosa cell tumor with tumor cells arranged in sheets and have presence of nuclear grooves (H&E,400X)



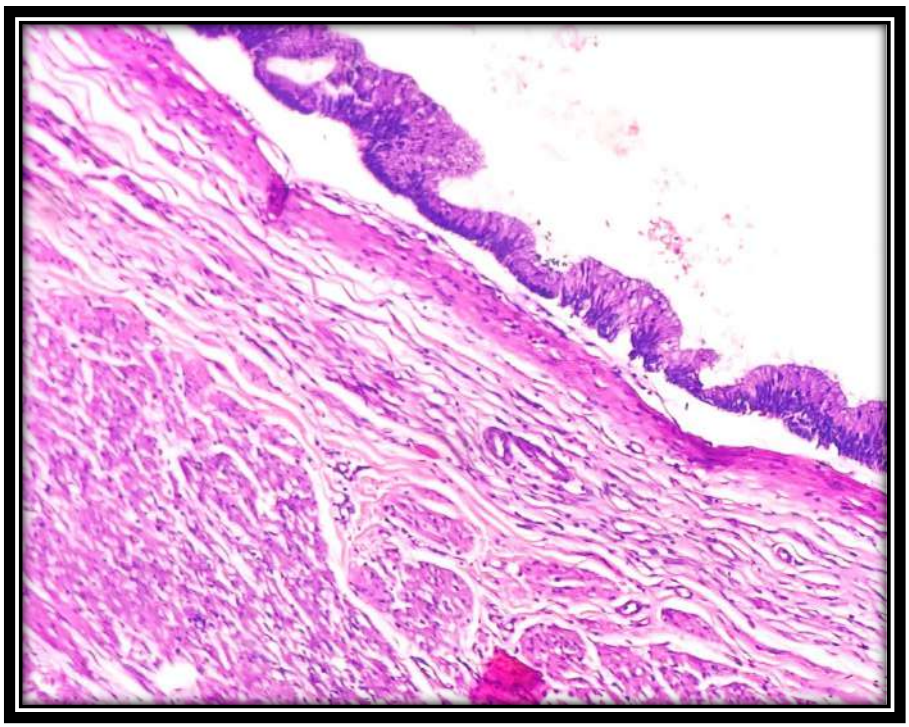
Picture 27 – Frozen section from ovarian mass shows necrosis only (H&E, 400X)



Picture 28 – Final histopathology of ovarian mass shows yolk sac tumor exhibiting a reticular pattern (H&E, 400X)



Picture 29 – Frozen section of appendix showing normal histology (H&E,100X)



Picture 30– Final histopathology of appendix showing low grade appendiceal neoplasm with proliferation of mucinous epithelial cell lining (H&E,100X)

PROFORMA

Sr. No. _____

Prior intimation of Frozen section (Yes/No):

Name :

Age:

MRD No.:

Sex:

Frozen Section No:

Date and Time:

Histopath No.:

Address :

Time of Specimen Received:

Clinical History:

Biochemical/Pathology/Microbiological Investigations(If any):

- Hemogram:
- Tumour Markers:
  - CA-125
  - CA 19-9
  - CEA
  - AFP
  - LDH
  - Beta HCG
- Cultures(Blood /Urine):

Radiological Investigation(USG/MRI/CT scan):

- Size:
- Location:
- Number of lesions:
- Mass:
- Calcification:

Clinical Diagnosis:

Radiological Diagnosis:

Signature of candidate

Signature of Supervisor

Type of Specimen(Large Specimen/Small Specimen):

Site of Specimen:

Indications of doing Frozen section:

- Presence of the lesion
- Nature of lesion (Benign/Malignant)
- Resected Margins
- Evidence of invasion
- Infection
- Others

Gross examination:

- Specimen Inked/Sutures (present/not present):
- Size of the lesion:
- Location of the lesion:
- Consistency of the tissue(Hard/Firm/Rubbery/Soft):
- Capsule (Present/Not present)
- On Cut Section:
    - Architectural appearance of the lesion:
    - Solid/Cystic Areas (present/not present):
        - If cystic color and consistency of the fluid:
    - Areas of Necrosis (present/not present):
    - Hemorrhagic areas (present/not present):
- Others (If Any):

Frozen section cutting temperature range:

Signature of candidate

Signature of Supervisor

Microscopic examination:

- Normal Anatomical tissue (present/not present):
- Borders of the lesion (encapsulated/well circumscribed/poorly circumscribed/infiltrative/pushing borders)
- Epithelium (intact/eroded):
- If Infective/Inflammatory pathology:
    - Areas of necrosis (present/not present):
    - Ares of hemorrhage (present/not present):
    - Inflammatory infiltrate (Acute/Chronic):
    - Granulomas (present/not present):
    - Multinucleated giant cells (present/not present):
    - Organism (bacteria/fungus) If any:
    - Background:

- If Tumor pathology:
    - Patterns of Arrangement of tumor cells:
    - Anaplasia (present/not present):
    - Individual tumor cell:
    - Necrosis and hemorrhage (present/not present):
    - Calcification (present/not present):
    - Angioinvasion (present/not present):
    - Capsular invasion (present/not present):
    - Stroma:
    - Special features (mucin/keratin pearls/granulomas/etc):

- Resected Margins (Involved/Not involved):
    - Malignant cells (present/not present):

- Other Feature (if any):

Frozen section diagnosis:

Signature of candidate

Signature of Supervisor

Time of reporting:

Imprint Smear Preparation (done/not done):

- If done then Impression of the same:

Deferred case (Yes/No):

Reasons for Deferred Diagnosis:

- Freezing artifacts:
- Tumour necrosis:
- Sample inadequate:
- Others:

Change in Surgical Management (Yes/No) :

- If yes then what:

Final histopathological diagnosis:

Concordant/Discordant:

Reason for discordant diagnosis:

- Sampling error
- Interpretation error
- Communication Problem
- Others

Signature of candidate

Signature of Supervisor

KEY TO MASTERCHART

M	MALE
F	FEMALE
FS	FROZEN SECTION
CA	CARCINOMA
IPMN	INTRADUCTAL PAPILLARY MUCINOUS NEOPLASM
HCC	HEPATOCELLULAR CARCINOMA
RPOC	RETAINED PRODUCTS OF CONCEPTION
LAR	LOW ABDOMINAL RESECTION

Sr.No	MRD NUMBER	Prior intimation	AGE	SEX	FROZEN SECTION NUMBER	HISTOPATH NUMBER	TIME OF SPECIMEN RECEIVED	CLINICAL DIAGNOSIS	TYPE OF SPECIMEN	SITE OF SPECIMEN	INDICATIONS OF DOING FROZEN SECTION
1	163467	YES	46	M	21-FS-17	21-2059	1:10PM	CA URINARY BLADDER	SMALL	RIGHT URETER MARGIN	RESECTED MARGIN STATUS
2	163467	YES	46	M	21-FS-18	21-2060	1:10PM	CA URINARY BLADDER	SMALL	LEFT URETER MARGIN	RESECTED MARGIN STATUS
3	1039884	YES	72	F	21-FS-19	21-2073	2:25PM	MUCINOUS NEOPLASM	SMALL	APPENDICULAR ABSCESS	PRIMARY DIAGNOSIS
4	1040709	YES	45	F	21-FS-20	22-2092	1:00PM	THICKENED ENDO	SMALL	ENDOMETRIAL CURRETINGS	PRIMARY DIAGNOSIS
5	1041605	YES	60	F	21-FS-21	21-2239	12:40PM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
6	1044952	YES	47	F	21-FS-22	21-2322	11:50AM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
7	1044952	YES	47	F	21-FS-23	21-2323	11:50AM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
8	1048259	YES	50	F	21-FS-24	21-2419	12:45PM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
9	1048359	YES	50	F	21-FS-25	21-2419	12:45PM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
10	783265	YES	46	F	21-FS-26	21-2667	12:10PM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
11	1059192	NO	63	F	21-FS-27	21-2696	10:20AM	CA OVARY	LARGE	LEFT OVARY	PRIMARY DIAGNOSIS
12	1060395	YES	53	F	21-FS-28	21-????	11:25AM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
13	1065852	YES	64	F	21-FS-29	21-2940	11:20AM	CA GALL BLADDER	SMALL	GALL BLADDER MASS	PRIMARY DIAGNOSIS
14	225344	YES	38	F	21-FS-30	21-2974,21-2975	11:50AM	CERVICAL CARCINOMA	SMALL	CERVICAL BIOPSY	PRIMARY DIAGNOSIS
15	973292	YES	45	F	21-FS-31	21-2966,2972	3:10PM	THICKENED ENDO	SMALL	ENDOMETRIAL CURRETINGS	PRIMARY DIAGNOSIS
16	1066378	YES	48	F	21-FS-32	21-3069	12:16PM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
17	1079480	YES	53	F	21-FS-33	21-3280,21-3348	11:20AM	RIGHT PARIETAL SOL	SMALL	RIGHT PARIETAL BIOPSY	PRIMARY DIAGNOSIS
18	1058831	YES	49	F	21-FS-35	21-3314,21-3315	12:40PM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
19	1058831	YES	49	F	21-FS-35	21-3314,21-3316	12:40PM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
20	282143	YES	69	M	21-FS-36	21-3279	1:00PM	CA GALL BLADDER	SMALL	GALL BLADDER MASS	PRIMARY DIAGNOSIS
21	1077972	YES	57	F	21-FS-37	21-3356	1:20PM	CA ENDOMETRIUM	LARGE	HYSTERECTOMY SPECIMEN	PRIMARY DIAGNOSIS
22	1083872	YES	78	F	21-FS-38	21-3455	12:00PM	CA GALL BLADDER	SMALL	LIVER BIOPSY	METASTASIS
23	995797	YES	37	F	21-FS-39	21-3499	10:00:00	LEFT OVARY CYSTADENOMA	LARGE	LEFT OVARY	PRIMARY DIAGNOSIS
24	1083923	YES	43	F	21-FS-40	21-3596	12:40PM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
25	1093251	YES	27	F	21-FS-41	21-3672	12:30PM	MOLAR PREGNANCY	SMALL	RPOC	PRIMARY DIAGNOSIS
26	1004526	YES	70	M	21-FS-42	21-4168	11:30AM	CA RECTUM	LARGE	LAR SPECIMEN	RESECTED MARGIN STATUS
27	1113226	YES	45	F	21-FS-43	21-4216	11:10AM	LEFT OVARY MASS	LARGE	LEFT OVARY	PRIMARY DIAGNOSIS
28	552756	YES	60	F	21-FS-44	21-4219,21-4226	12:30PM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
29	1115341	YES	43	F	21-FS-45	21-4390.4384	1:05PM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
30	842348	YES	63	M	21-FS-46	21-4561	11:35AM	CA URINARY BLADDER	SMALL	URETER	RESECTED MARGIN STATUS
31	1121300	YES	39	F	21-FS-47	21-4655	12:10PM	RIGHT OVARY MASS	LARGE	HYSTERECTOMY SPECIMEN	PRIMARY DIAGNOSIS
32	1120239	YES	70	F	21-FS-48	21-4751	12:35PM	CA STOMACH	SMALL	PERITONEAL BIOPSY	METASTASIS
33	1119940	YES	67	F	21-FS-49	21-4785	1:00PM	CARCINOMA	SMALL	TONGUE BIOPSY	PRIMARY DIAGNOSIS
34	188705	YES	45	F	21-FS-50	21-4780	1:15PM	PARATHYROID ADENOMA	LARGE	PARATHYROID GLAND	PRIMARY DIAGNOSIS
35	1123127	YES	65	F	21-FS-51	21-4818	1:45PM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
36	1122761	YES	58	F	21-FS-52	21-4845	12:10PM	RIGHT OVARY MASS	LARGE	RIGHT OVARY	PRIMARY DIAGNOSIS
37	1123264	YES	69	M	21-FS-53	21-5358	11:00AM	BILE DUCT NEOPLASM	SMALL	BILE DUCT MARGIN	RESECTED MARGIN STATUS
38	1126869	YES	64	M	21-FS-54	21-5328	11:30AM	CA BUCCAL MUCOSA	SMALL	BUCCAL MUCOSA BIOPSY	PRIMARY DIAGNOSIS
39	1128085	YES	72	M	21-FS-55	21-5423	12:05PM	CA URINARY BLADDER	SMALL	URETER	RESECTED MARGIN STATUS
40	1131841	YES	58	M	21-FS-56	21-5663	11:40AM	CA URINARY BLADDER	SMALL	URETER	RESECTED MARGIN STATUS
41	1057805	YES	27	M	21-FS-57	21-5704	11:05AM	CA ESOPHAGUS	SMALL	NODULES	METASTASIS
42	1132112	YES	45	M	21-FS-58	21-5820	11:30AM	CA GALL BLADDER	SMALL	CBD MARGIN	RESECTED MARGIN STATUS
43	507006	YES	40	F	21-FS-59	21-5779,21-5795	11:45AM	RIGHT OVARY MASS	LARGE	RIGHT OVARY	PRIMARY DIAGNOSIS
44	1141899	YES	66	F	21-FS-60	21-5835	12:50PM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
45	1129217	YES	31	F	21-FS-61	21-5881	1:00PM	RIGHT OVARY MASS	SMALL	OVARIAN CYST	PRIMARY DIAGNOSIS
46	1129217	YES	31	F	21-FS-62	21-5882	1:00PM	RIGHT OVARY MASS	SMALL	OVARIAN CYST	PRIMARY DIAGNOSIS
47	1130414	YES	72	F	21-FS-63	21-5917	12:50PM	CA GALL BLADDER	SMALL	CYSTIC DUCT MARGIN	RESECTED MARGIN STATUS

Sr.No	MRD NUMBER	FROZEN SECTION DIAGNOSIS	TIME OF REPORTING	REVERT TIME	IMPRINT SMEAR PREPARATION (DONE/NOT DONE)	DEFFERRED CASE (YES/NO)	CHANGE IN SURGICAL MANAGEMENT (YES/NO)	FINAL HISTOPATHOLOGICAL DIAGNOSIS	CONCORDANT/ DISCORDANT
1	163467	NO TUMOR	1:35PM	00:25:00	NO	NO	NO	FREE OF TUMOR	CONCORDANT
2	163467	NO TUMOR	1:35PM	00:25:00	NO	NO	NO	FREE OF TUMOR	CONCORDANT
3	1039884	THICKENED APPENDICULAR WALL	3:00PM	00:35:00	NO	NO	NO	ACUTE APPENDICITIS AND PERI	CONCORDANT
4	1040709	SIMPLE HYPERPLASIA WITHOUT ATYPIA	1:30PM	00:30:00	NO	NO	NO	SECRETORY ENDOMETRIUM	CONCORDANT
5	1041605	REACTIVE HYPERPLAISA	1:10PM	00:30:00	NO	NO	NO	REACTIVE HYPERPLASIA	CONCORDANT
6	1044952	METASTATIC DEPOSITS	12:15PM	00:25:00	NO	NO	YES	METASTATIC DEPOSITS	CONCORDANT
7	1044952	METASTATIC DEPOSITS	12:15PM	00:25:00	NO	NO	YES	METASTATIC DEPOSITS	CONCORDANT
8	1048259	METASTATIC DEPOSITS	1:15PM	00:30:00	NO	NO	YES	METASTATIC DEPOSITS	CONCORDANT
9	1048359	SUSPICIOUS OF MALIGNANCY	1:15PM	00:30:00	NO	NO	YES	REACTIVE HYPERPLASIA	DISCORDANT
10	783265	REACTIVE HYPERPLAISA	12:40PM	00:30:00	NO	NO	NO	REACTIVE HYPERPLASIA	CONCORDANT
11	1059192	MUCINOUS NEOPLASM	10:55AM	00:35:00	NO	NO	YES	MUCINOUS CARCINIOMA WITH INTESTINAL DIFFERENTIATION	CONCORDANT
12	1060395	REACTIVE HYPERPLAISA	11:56AM	00:31:00	NO	NO	NO	REACTIVE HYPERPLASIA	CONCORDANT
13	1065852	CARCINOMA	11:43AM	00:23:00	NO	NO	YES	ADENOSQUAMOUS CARCINOMA	CONCORDANT
14	225344	STRATIFIED SQUAMOUS EPITHELIUM	12:10PM	00:20:00	NO	NO	NO	FREE OF TUMOR	CONCORDANT
15	973292	PROLIFERATIVE ENDOMETRIUM	3:40PM	00:30:00	NO	NO	NO	PROLIFERATIVE ENDOMETRIUM	CONCORDANT
16	1066378	REACTIVE HYPERPLAISA	12:45PM	00:29:00	NO	NO	NO	METASTATIC DEPOSITS	DISCORDANT
17	1079480	MALIGNANT NEOPLASM	12:00PM	00:40:00	NO	NO	YES	HIGH GRADE GLIOMA	CONCORDANT
18	1058831	REACTIVE HYPERPLAISA	1:15PM	00:35:00	NO	NO	NO	REACTIVE HYPERPLASIA	CONCORDANT
19	1058831	REACTIVE HYPERPLAISA	1:15PM	00:35:00	NO	NO	NO	REACTIVE HYPERPLASIA	CONCORDANT
20	282143	THICKENED WALL WITH DENSE INFLAMMATORY INFILTRATE	1:25PM	00:25:00	NO	NO	NO	XANTHGRANULOMATOUS CHOLECYSTITIS	CONCORDANT
21	1077972	NUCLEAR STRATIFICATION WITH COMPACT STROMA	1:50PM	00:30:00	NO	NO	NO	DISORDERED PROLIFERATIVE ENDOMETRIUM	CONCORDANT
22	1083872	HEPATOCYTES	12:25PM	00:25:00	NO	NO	NO	XANTHOGRANULOMATOUS CHOLECYSTITIS	CONCORDANT
23	995797	BENIGN CYSTIC LESION	10:30AM	00:30:00	NO	NO	NO	BRENNERS'S TUMOR	CONCORDANT
24	1083923	METASTATIC DEPOSITS	1:05PM	00:25:00	NO	NO	YES	METASTATIC DEPOSITS	CONCORDANT
25	1093251	CHORIONIC VILLI	12:55PM	00:25:00	NO	NO	NO	DEGENERATED PRODUCTS OF GESTATION	CONCORDANT
26	1004526	NO TUMOR	11:55AM	00:25:00	NO	NO	NO	FREE OF TUMOR	CONCORDANT
27	1113226	ENDOMETRIOSIS	11:42AM	00:32:00	NO	NO	NO	ENDOMETRIOTIC CYST	CONCORDANT
28	552756	REACTIVE HYPERPLAISA	12:56PM	00:26:00	NO	NO	NO	REACTIVE HYPERPLAISA	CONCORDANT
29	1115341	REACTIVE HYPERPLAISA	1:35PM	00:30:00	NO	NO	NO	METASTATIC DEPOSITS	DISCORDANT
30	842348	NO TUMOR	12:10PM	00:35:00	NO	NO	NO	FREE OF TUMOR	CONCORDANT
31	1121300	CYST WALL LINED BY FOAMY MACROPHAGES	12:40PM	00:30:00	NO	NO	NO	HEMOSIDERIN LADEN MACROPHAGES	CONCORDANT
32	1120239	SUSPICIOUS OF MALIGNANCY	1:10PM	00:35:00	NO	NO	NO	METASTATIC DEPOSITS	DISCORDANT
33	1119940	SQUAMOUS CELL CARCINOMA	1:26PM	00:26:00	NO	NO	YES	SQUAMOUS CELL CARCINOMA	CONCORDANT
34	188705	PARATHYROID ADENOMA	1:40PM	00:25:00	NO	NO	NO	PARATHYROID ADENOMA	CONCORDANT
35	1123127	METASTATIC DEPOSITS	2:05PM	00:20:00	NO	NO	YES	METASTATIC DEPOSITS	CONCORDANT
36	1122761	OVARIAN STROMA WITH CHRONIC INFLAMMATORY CELLS	12:40PM	00:30:00	NO	NO	NO	OVARIAN STROMA WITH CORPUS ALBICANS	CONCORDANT
37	1123264	NO TUMOR	11:40AM	00:40:00	NO	NO	NO	FREE OF TUMOR	CONCORDANT
38	1126869	STRATIFIED SQUAMOUS EPITHELIUM WITH AREAS OF ULCERATION	12:00PM	00:30:00	NO	NO	NO	SQUAMOUS CELL CARCINOMA	CONCORDANT
39	1128085	NO TUMOR	12:30PM	00:25:00	NO	NO	NO	FREE OF TUMOR	CONCORDANT
40	1131841	NO TUMOR	12:10PM	00:30:00	NO	NO	NO	FREE OF TUMOR	CONCORDANT
41	1057805	CARCINOMA	11:35AM	00:30:00	NO	NO	YES	CARCINIOMA	CONCORDANT
42	1132112	DYSPLASIA	11:30AM	00:00:00	NO	NO	YES	BILIARY INTRAEPITHELIAL NEOPLASIA	CONCORDANT
43	507006	ENDOMETRIOSIS	12:10PM	00:25:00	NO	NO	NO	ENDOMETRIOSIS	CONCORDANT
44	1141899	METASTATIC DEPOSITS	1:18PM	00:28:00	NO	NO	YES	METASTATIC DEPOSITS	CONCORDANT
45	1129217	OVARIAN STROMA	1:45PM	00:45:00	NO	NO	NO	ENDOMETRIOTIC CYST	CONCORDANT
46	1129217	CORPUS ALBICANS AND OVARIAN STROMA	1:45PM	00:45:00	NO	NO	NO	CORPUS ALBICANS AND CORPUS LUTEAL CYST	CONCORDANT
47	1130414	NO TUMOR	1:30PM	00:40:00	NO	NO	NO	FREE OF TUMOR	CONCORDANT

Sr.No	MRD NUMBER	Prior intimation	AGE	SEX	FROZEN SECTION NUMBER	HISTOPATH NUMBER	TIME OF SPECIMEN RECEIVED	CLINICAL DIAGNOSIS	TYPE OF SPECIMEN	SITE OF SPECIMEN	INDICATIONS OF DOING FROZEN SECTION
48	1114735	NO	40	F	21-FS-64	21-6168	12:50PM	CA ENDOMETRIUM	LARGE	HYSTERECTOMY SPECIMEN	PRIMARY DIAGNOSIS
49	1126039	YES	56	F	21-FS-65	21-6207	12:50PM	PERIAMPULLARY CA	LARGE	GALL BLADDER	METASTASIS
50	6987	YES	49	F	21-FS-66	21-6292	3:00PM	CERVICAL POLYP	SMALL	CERVICAL POLYP	PRIMARY DIAGNOSIS
51	1140151	YES	32	F	21-FS-67	21-6289	10:30AM	CARCINOMA GB	SMALL	GALL BLADDER WALL THICKENING	PRIMARY DIAGNOSIS
52	1140151	YES	32	F	21-FS-68	21-6289	10:30AM	CARCINOMA GB	SMALL	GALL BLADDER WALL THICKENING	PRIMARY DIAGNOSIS
53	1137914	YES	35	F	21-FS-69	21-6332,21-6309	11:15AM	DUODENAL MASS	LARGE	SEGMENT OF INTESTINE	PRIMARY DIAGNOSIS
54	1143037	YES	55	F	21-FS-70	21-6445,6457	10:10AM	RIGHT OVARY MASS	LARGE	RIGHT OVARY	PRIMARY DIAGNOSIS
55	1143645	YES	47	F	21-FS-71	21-6446	2:00PM	CA ENDOMETRIUM	SMALL	ENDOMETRIAL CURRETINGS	PRIMARY DIAGNOSIS
56	1142952	YES	48	F	21-FS-72	21-6565	1:30PM	OVARIAN MASS	LARGE	OVARY	PRIMARY DIAGNOSIS
57	1139173	YES	61	F	21-FS-73	21-6571	12:45PM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
58	1140445	YES	34	M	21-FS-74	21-6575	1:20PM	CA THYROID	LARGE	HEMITHYROIDECTOMY SPECIMEN	PRIMARY DIAGNOSIS
59	834942	YES	58	F	21-FS-75	21-6637,21-6648	12:30PM	CA STOMACH	SMALL	PERITONEAL DEPOSITS	METASTASIS
60	1139277	YES	21	F	21-FS-76	21-6674	1:10PM	HEMANGIOMA SCALP	SMALL	SCALP SWELLING	PRIMARY DIAGNOSIS
61	333546	YES	62	F	21-FS-77	21-6763,21-6764	1:00PM	CA APPENDIX	LARGE	APPENDIX	PRIMARY DIAGNOSIS
62	1131927	YES	67	M	21-FS-78	21-6788,21-6829	12:30PM	CARCINOMA	SMALL	NODULE OVER SIGMOID MESENTER	METASTASIS
63	1010166	YES	49	F	21-FS-79	21-6878,21-6911	11:40AM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
64	1147409	YES	43	F	21-FS-80	21-6880,21-6913	12:05PM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
65	1147409	YES	43	F	21-FS-81	21-6880,21-6914	12:05PM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
66	1147675	YES	70	F	21-FS-82	21-6996	1:10PM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
67	1146563	YES	45	F	21-FS-83	21-7079	11:40AM	PARATHYROID ADENOMA	SMALL	PARATHYROID GLAND	PRIMARY DIAGNOSIS
68	1152391	NO	74	F	21-FS-84	21-7137	12:40PM	OVARIAN CYST	LARGE	OVARIAN CYST	PRIMARY DIAGNOSIS
69	1149526	YES	43	F	21-FS-85	21-7174	3:00PM	APPENDICULAR NEOPLASM	LARGE	APPENDIX	PRIMARY DIAGNOSIS
70	1146627	YES	49	F	21-FS-86	21-7260	2:45PM	CA PANCREAS	SMALL	PANCREATIC DUCT MARGIN	RESECTED MARGIN STATUS
71	1146627	YES	49	F	21-FS-87	21-7260	2:45PM	CA PANCREAS	SMALL	PANCREATIC DUCT MARGIN	RESECTED MARGIN STATUS
72	1146627	YES	49	F	21-FS-88	21-7260	2:45PM	CA PANCREAS	SMALL	PANCREATIC DUCT MARGIN	RESECTED MARGIN STATUS
73	481154	YES	61	M	21-FS-89	21-7232	3:40PM	PARATHYROID ADENOMA	SMALL	PARATHYROID GLAND	PRIMARY DIAGNOSIS
74	1143575	YES	13	F	21-FS-90	21-7275,21-7295	2:45PM	FUNGAL GRANULOMA	SMALL	LEFT PARIETAL LESION	PRIMARY DIAGNOSIS
75	218363	YES	44	F	21-FS-91	21-7489	2:05PM	CA ENDOMETRIUM	SMALL	ENDOMETRIAL CURRETINGS	PRIMARY DIAGNOSIS
76	1155282	YES	73	M	21-FS-92	21-7423,21-7510	3:00PM	CA GALL BLADDER	LARGE	GALL BLADDER	PRIMARY DIAGNOSIS
77	861222	YES	43	F	21-FS-93	21-7467,21-7468	3:30PM	PARATHYROID ADENOMA	LARGE	PARATHYROID GLAND	PRIMARY DIAGNOSIS
78	1145937	YES	55	M	21-FS-94	21-7395	10:30AM	CA RECTUM	SMALL	RECTAL POLYP BIOPSY	PRIMARY DIAGNOSIS
79	1157376	YES	45	F	21-FS-95	21-7558	11:10AM	CA OVARY	LARGE	LEFT OVARIAN CYST	PRIMARY DIAGNOSIS
80	1144711	YES	67	M	21-FS-96	21-7655	12:10PM	PARATHYROID ADENOMA	SMALL	PARATHYROID GLAND	PRIMARY DIAGNOSIS
81	1160680	YES	36	F	21-FS-97	21-7661,21-7689	12:05PM	CA OVARY	LARGE	RIGHT OVARIAN CYST	PRIMARY DIAGNOSIS
82	1160695	YES	72	M	21-FS-98	21-7977	2:05PM	CA PANCREAS	SMALL	BILE DUCT MARGIN	RESECTED MARGIN STATUS
83	1139651	YES	64	F	21-FS-99	21-8180	10:05AM	CA OVARY	LARGE	LEFT OVARY	PRIMARY DIAGNOSIS
84	908068	NO	24	F	21-FS-100	21-8337	1:45PM	PARATHYROID ADENOMA	LARGE	PARATHYROID GLAND	PRIMARY DIAGNOSIS
85	1169161	YES	65	F	21-FS-101	21-8279	11:20AM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
86	1169161	YES	65	F	21-FS-102	21-8279	11:20AM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
87	646015	YES	48	M	21-FS-103	21-8283,21-8319	10:20AM	CARCINOMA	SMALL	DEEP MARGIN	RESECTED MARGIN STATUS
88	410462	YES	75	F	21-FS-104	21-8282,21-8301	11:00AM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
89	1164344	YES	70	F	21-FS-105	21-8339,8326	10:10AM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
90	1174398	YES	44	F	21-FS-106	21-8634,21-8641	11:05AM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
91	439752	YES	52	F	21-FS-107	21-8685,21-8712	11:30AM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS

Sr.No	MRD NUMBER	FROZEN SECTION DIAGNOSIS	TIME OF REPORTING	REVERT TIME	IMPRINT SMEAR PREPARATION (DONE/NOT DONE)	DEFFERRED CASE (YES/NO)	CHANGE IN SURGICAL MANAGEMENT (YES/NO)	FINAL HISTOPATHOLOGICAL DIAGNOSIS	CONCORDANT/ DISCORDANT
48	1114735	ATYPICAL SMOOTH MUSCLE TUMOR	1:45PM	00:55:00	NO	NO	YES	STUMP	CONCORDANT
49	1126039	NO TUMOR	1:20PM	00:30:00	NO	NO	NO	FREE OF TUMOR	CONCORDANT
50	6987	ENDOCERVICAL GLANDS WITH TALL COLUMNAR EPITHELIUM	3:25PM	00:25:00	NO	NO	NO	FREE OF TUMOR	CONCORDANT
51	1140151	LYMPHOID AGGREGATES WITH LYMPHOCYTES	11:00AM	00:30:00	NO	NO	NO	XANTHOGRANULOMATOUS CHOLECYSTITIS	CONCORDANT
52	1140151	ACUTE AND CHRONIC INFLAMMATORY CELLS WITH THICKENED WALL	11:00AM	00:30:00	NO	NO	NO	XANTHOGRANLOMATOUS CHOLECYSTITIS	CONCORDANT
53	1137914	EPITHELIAL NEOPLASM	11:40PM	00:25:00	NO	NO	YES	NEOPLASM -NEUROENDOCRINE	CONCORDANT
54	1143037	OVARIAN STROMA WITH HEMOSIDERIN LADEN MACROPHAGES	10:30AM	00:20:00	NO	NO	NO	FREE OF TUMOR	CONCORDANT
55	1143645	PROLIFERATIVE ENDOMETRIUM	2:30PM	00:30:00	NO	NO	NO	PROLIFERATIVE ENDOMETRIUM	CONCORDANT
56	1142952	CARCINOMA	2:00PM	00:30:00	NO	NO	YES	ADULT GRNULOSA CELL TUMOR	CONCORDANT
57	1139173	REACTIVE HYPERPLAISA	1:15PM	00:30:00	NO	NO	NO	METASTATIC DEPOSITS	DISCORDANT
58	1140445	MULTINODULAR GOITRE	1:45PM	00:25:00	NO	NO	NO	MULYINODULAR GOITRE	CONCORDANT
59	834942	SUSPICIOUS OF MALIGNANCY	1:10PM	00:40:00	NO	NO	NO	SIGNET RING CELL CARCINOMA	CONCORDANT
60	1139277	NECROSIS WITH LYMPHOCYTES	1:40PM	00:30:00	NO	NO	NO	NECROSIS	CONCORDANT
61	333546	APPENDIX MUCOSA UNREMARKABLE WITH HYPERPLASIA OF LYMPHOID FOLLICLES	1:30PM	00:30:00	NO	NO	NO	ACUTE APPENDICITIS AND PERIAPPENDICITIS	CONCORDANT
62	1131927	SUSPICIOUS OF MALIGNANCY	1:05PM	00:35:00	NO	NO	YES	FREE OF TUMOR	DISCORDANT
63	1010166	REACTIVE HYPERPLAISA	12:10PM	00:30:00	NO	NO	NO	METASTATIC DEPOSITS	DISCORDANT
64	1147409	METASTATIC DEPOSITS	12:35PM	00:30:00	NO	NO	YES	METASTATIC DEPOSITS	CONCORDANT
65	1147409	SUSPICIOUS OF MALIGNANCY	12:35PM	00:30:00	NO	NO	NO	FIBROCYSTIC DISEASE	CONCORDANT
66	1147675	REACTIVE HYPERPLAISA	1:35PM	00:25:00	NO	NO	NO	REACTIVE HYPERPLASIA	CONCORDANT
67	1146563	PARATHYROID NEOPLASM	12:10PM	00:30:00	NO	NO	NO	PARATHYROID ADENOMA	CONCORDANT
68	1152391	OVARIAN STROMA	1:15PM	00:35:00	NO	NO	NO	SIMPLE CYST	CONCORDANT
69	1149526	NO TUMOR	3:40PM	00:40:00	NO	NO	NO	LOW GRADE APPENDICEAL NEOPLASM	DISCORDANT
70	1146627	SUSPICIOUS OF MALIGNANCY	3:05PM	00:20:00	NO	NO	YES	SUSPICIOUS OF NEOPLASM	CONCORDANT
71	1146627	PAPILLARY NEOPLASM	3:05PM	00:20:00	NO	NO	YES	PAPILLARY NEOPLASM	CONCORDANT
72	1146627	NO TUMOR	3:05PM	00:20:00	NO	NO	NO	FREE OF TUMOR	CONCORDANT
73	481154	PARATHYROID ADENOMA	4:10PM	00:30:00	NO	NO	NO	PARATHYROID ADENOMA	CONCORDANT
74	1143575	GRANULOMATOUS INFLAMMATION WITH NEGATIVE SHADOWS IN GIANT CELLS	3:10PM	00:25:00	NO	NO	NO	FUNGAL GRANULOMA- ASPERGILLOSIS	CONCORDANT
75	218363	PROLIFERATIVE ENDOMETRIUM	3:05PM	01:00:00	NO	NO	NO	PROLIFERATIVE ENDOMETRIUM	CONCORDANT
76	1155282	PRESENCE OF GLANDS, NUCLEAR STRATIFICATION WITH NUCLEAR HYPERCHROMASIA	3:40PM	00:40:00	NO	NO	NO	ACUTE ON CHRONIC CHOLECYSTITIS WITH CHOLANGITIS AND HEPATOLITHIASIS	DEFFERED
77	861222	PARATHYROID ADENOMA	4:05PM	00:35:00	NO	NO	NO	PARATHYROID ADENOMA	CONCORDANT
78	1145937	VILLOUS ADENOMA WITH DYSPLASIA	11:10AM	00:40:00	NO	NO	YES	ADENOCARCINOMA	DISCORDANT
79	1157376	MALIGNANT NEOPLASM	12:05:00	00:55:00	NO	NO	NO	GRANULOSA CELL TUMOR	CONCORDANT
80	1144711	PARATHYROID ADENOMA	12:45PM	00:35:00	NO	NO	NO	PARATHYROID ADENOMA	CONCORDANT
81	1160680	OVARIAN STROMA	12:45PM	00:40:00	NO	NO	YES	OVARIAN STROMA WITH CORPUS ALBICANS	CONCORDANT
82	1160695	NO TUMOR	2:40PM	00:35:00	NO	NO	NO	FREE OF TUMOR	CONCORDANT
83	1139651	MUCINOUS NEOPLASM	10:45PM	00:40:00	NO	NO	NO	MUCINOUS NEOPLASM	CONCORDANT
84	908068	PARATHYROID ADENOMA	2:20PM	00:35:00	NO	NO	NO	PARATHYROID ADENOMA	CONCORDANT
85	1169161	REACTIVE HYPERPLAISA	12:00PM	00:40:00	NO	NO	NO	REACTIVE HYPERPLASIA	CONCORDANT
86	1169161	REACTIVE HYPERPLAISA	12:00PM	00:40:00	NO	NO	NO	REACTIVE HYPERPLASIA	CONCORDANT
87	646015	NO TUMOR	10:40AM	00:20:00	NO	NO	NO	FREE OF TUMOR	CONCORDANT
88	410462	REACTIVE HYPERPLAISA	11:35AM	00:35:00	NO	NO	NO	REACTIVE HYPERPLASIA	CONCORDANT
89	1164344	METASTATIC DEPOSITS	10:45AM	00:35:00	NO	NO	YES	METASTATIC DEPOSITS	CONCORDANT
90	1174398	METASTATIC DEPOSITS	11:30AM	00:25:00	NO	NO	YES	METASTATIC DEPOSITS	CONCORDANT
91	439752	REACTIVE HYPERPLAISA	12:05PM	00:35:00	NO	NO	NO	REACTIVE HYPERPLASIA	CONCORDANT

Sr.No	MRD NUMBER	Prior intimation	AGE	SEX	FROZEN SECTION NUMBER	HISTOPATH NUMBER	TIME OF SPECIMEN RECEIVED	CLINICAL DIAGNOSIS	TYPE OF SPECIMEN	SITE OF SPECIMEN	INDICATIONS OF DOING FROZEN SECTION
92	439752	YES	52	F	21-FS-108	21-8685,21-8713	11:30AM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
93	1172977	YES	50	F	21-FS-109	21-8687	1:05PM	CA CERVIX	SMALL	CERVICAL BIOPSY	PRIMARY DIAGNOSIS
94	1177069	YES	42	F	21-FS-110	21-8751	3:00PM	CA ENDOMETRIUM	SMALL	ENDOMETRIAL CURRETINGS	PRIMARY DIAGNOSIS
95	1174868	YES	69	F	21-FS-111	21-8788,21-8789	11:05:00	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
96	1174868	YES	69	F	21-FS-112	21-8788,21-8790	11:05AM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
97	1177886	YES	62	M	21-FS-113	21-8847	12:05PM	CA EYELID	SMALL	ULCERATIVE LESION	PRIMARY DIAGNOSIS
98	1166496	YES	45	F	21-FS-114	21-8883,21-8844	2:05PM	CA GALL BLADDER	LARGE	GALL BLADDER	PRIMARY DIAGNOSIS
99	1178076	YES	52	F	21-FS-115	21-8900	11:10AM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
100	1178076	YES	52	F	21-FS-116	21-8900	11:10AM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
101	1179064	YES	45	M	21-FS-117	21-8928	11:20AM	CA PANCREAS	SMALL	PANCREATIC DUCT MARGIN	RESECTED MARGIN STATUS
102	1175311	YES	53	M	21-FS-118	21-8904	12:10PM	CA PANCREAS	SMALL	PANCREATIC DUCT MARGIN	RESECTED MARGIN STATUS
103	1169297	YES	64	M	21-FS-119	21-9009	1:35PM	CA PANCREAS	SMALL	CBD MARGIN	RESECTED MARGIN STATUS
104	1173965	YES	52	F	21-FS-120	21-9077	11:10AM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
105	1179481	YES	48	F	21-FS-121	21-90033,21-9044	11:05AM	CA OVARY	LARGE	OVARIAN MASS	PRIMARY DIAGNOSIS
106	979249	YES	56	M	21-FS-122	21-9202	2:05PM	CA GALL BLADDER	LARGE	GALL BLADDER	PRIMARY DIAGNOSIS
107	1184852	YES	62	F	21-FS-123	21-9240	12:30PM	CA CERVIX	SMALL	CERVICAL POLYP	PRIMARY DIAGNOSIS
108	1181334	YES	45	M	21-FS-124	21-9241	1:10PM	CA PENIS	SMALL	INGUINAL LYMPH NODE	METASTASIS
109	1181334	YES	45	M	21-FS-125	21-9242	1:10PM	CA PENIS	SMALL	INGUINAL LYMPH NODE	METASTASIS
110	1184377	YES	37	F	21-FS-126	21-9305	2:25PM	CA CERVIX	SMALL	CERVICAL BIOPSY	PRIMARY DIAGNOSIS
111	1184965	YES	43	F	21-FS-127	21-9383	2:40PM	CA OVARY	LARGE	ADNEXAL AMSS	PRIMARY DIAGNOSIS
112	1186092	YES	53	F	21-FS-128	21-9696,21-9698	3:05PM	CARCINOMA	SMALL	LIVER NODULE	METASTASIS
113	1182371	YES	62	F	21-FS-129	21-9694	2:00PM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
114	1189215	YES	45	F	21-FS-130	21-9705	11:20AM	CA TONGUE	SMALL	TONGUE BIOPSY	PRIMARY DIAGNOSIS
115	1190119	YES	61	F	21-FS-131	21-9699	12:00PM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
116	1190119	YES	61	F	21-FS-132	21-9700	12:00PM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
117	1191450	YES	67	M	21-FS-133	21-9736	11:30AM	BASAL CELL CARCINOMA	SMALL	BASE AND RESECTED MARGIN	RESECTED MARGIN STATUS
118	1197837	YES	58	F	21-FS-134	21-10134	12:10PM	CA PAROTID	LARGE	PAROTID GLAND	PRIMARY DIAGNOSIS
119	1196534	YES	61	F	21-FS-135	21-10091	11:30AM	CA PANCREAS	SMALL	PANCREATIC DUCT MARGIN	RESECTED MARGIN STATUS
120	1199566	YES	67	F	21-FS-136	21-10332	1:00PM	CA OVARY	LARGE	OVARIAN CYST	PRIMARY DIAGNOSIS
121	1130609	YES	27	M	21-FS-137	21-10448	12:45PM	CA RECTUM	SMALL	RESECTED MARGIN	RESECTED MARGIN STATUS
122	1200227	YES	55	F	21-FS-138	21-10500	11:40AM	PARATHYROID ADENOMA	LARGE	PARATHYROID GLAND	PRIMARY DIAGNOSIS
123	1206547	YES	65	F	21-FS-139	21-10688	12:35PM	CA OVARY	LARGE	OVARIAN MASS	PRIMARY DIAGNOSIS
124	1206950	YES	64	F	21-FS-140	21-10862	1:10PM	CA OVARY	SMALL	RIGHT OVARIAN BIOPSY	PRIMARY DIAGNOSIS
125	1206950	YES	64	F	21-FS-141	21-10862	1:10PM	CA OVARY	SMALL	LEFT OVARIAN BIOPSY	PRIMARY DIAGNOSIS
126	1162449	YES	67	M	21-FS-142	21-10916	2:05PM	RIGHT FRONTOPARIETAL SOL	SMALL	FRONTOPARIETAL SOL	PRIMARY DIAGNOSIS
127	563460	YES	73	F	21-FS-143	21-10908	11:05PM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
128	1215777	YES	72	F	21-FS-144	21-11326	12:15PM	CA OVARY	LARGE	RIGHT ADENXAL MASS	PRIMARY DIAGNOSIS
129	1172476	YES	47	F	21-FS-145	21-11366	1:05PM	CA ENDOMETRIUM	SMALL	ENDOMETRIAL CURRETINGS	PRIMARY DIAGNOSIS
130	1210697	YES	59	F	21-FS-146	21-11368	2:10PM	CA TONGUE	SMALL	ANTERIOR MARGIN	RESECTED MARGIN STATUS
131	1210697	YES	59	F	21-FS-147	21-11368	2:10PM	CA TONGUE	SMALL	POSTERIOR MARGIN	RESECTED MARGIN STATUS
132	1210697	YES	59	F	21-FS-148	21-11368	2:10PM	CA TONGUE	SMALL	LATERAL MARGIN	RESECTED MARGIN STATUS
133	1210697	YES	59	F	21-FS-149	21-11368	2:10PM	CA TONGUE	SMALL	MEDIAL MARGIN	RESECTED MARGIN STATUS
134	1210697	YES	59	F	21-FS-150	21-11368	2:10PM	CA TONGUE	SMALL	BASE	RESECTED MARGIN STATUS
135	1186626	YES	60	F	21-FS-151	21-11396	2:30PM	CA OVARY	LARGE	OVARIAN MASS	PRIMARY DIAGNOSIS
136	1186626	YES	56	F	21-FS-152	21-11426	1:10PM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
137	1214871	YES	56	F	21-FS-153	21-11427	1:10PM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
138	1214871	YES	56	F	21-FS-154	21-11475	2:00PM	BASAL CELL CARCINOMA	SMALL	MEDIAL MARGIN	RESECTED MARGIN STATUS

Sr.No	MRD NUMBER	FROZEN SECTION DIAGNOSIS	TIME OF REPORTING	REVERT TIME	IMPRINT SMEAR PREPARATION (DONE/NOT DONE)	DEFFERRED CASE (YES/NO)	CHANGE IN SURGICAL MANAGEMENT (YES/NO)	FINAL HISTOPATHOLOGICAL DIAGNOSIS	CONCORDANT/ DISCORDANT
92	439752	REACTIVE HYPERPLAISA	12:05PM	00:35:00	NO	NO	NO	REACTIVE HYPERPLASIA	CONCORDANT
93	1172977	SQUAMOUS CELL CARCINOMA	1:45PM	00:40:00	NO	NO	YES	SQUAMOUS CELL CARCINOMA	CONCORDANT
94	1177069	SECRETORY ENDOMETRIUM	3:35PM	00:35:00	NO	NO	NO	SECRETORY ENDOMETRIUM	CONCORDANT
95	1174868	METASTATIC DEPOSITS	11:45AM	00:40:00	NO	NO	YES	METASTATIC DEPOSITS	CONCORDANT
96	1174868	REACTIVE HYPERPLAISA	11:45AM	00:40:00	NO	NO	NO	REACTIVE HYPERPLASIA	CONCORDANT
97	1177886	FIBROCOLLAGENOUS TISSUE	12:40PM	00:35:00	NO	NO	NO	BASAL CELL CARCINOMA	DISCORDANT
98	1166496	NO TUMOR	2:45PM	00:40:00	NO	NO	NO	FREE OF TUMOR	CONCORDANT
99	1178076	METASTATIC DEPOSITS	11:45AM	00:35:00	NO	NO	YES	METASTATIC DEPOSITS	CONCORDANT
100	1178076	REACTIVE HYPERPLAISA	11:45AM	00:35:00	NO	NO	NO	FREE OF TUMOR	CONCORDANT
101	1179064	NO TUMOR	12:00PM	00:40:00	NO	NO	NO	FREE OF TUMOR	CONCORDANT
102	1175311	NO TUMOR	12:45PM	00:35:00	NO	NO	NO	FREE OF TUMOR	CONCORDANT
103	1169297	NO TUMOR	2:10PM	00:35:00	NO	NO	NO	FREE OF TUMOR	CONCORDANT
104	1173965	REACTIVE HYPERPLAISA	11:45AM	00:35:00	NO	NO	NO	REACTIVE HYPERPLASIA	CONCORDANT
105	1179481	MALIGNANT TUMOR	11:45AM	00:40:00	NO	NO	YES	ADENOCARCINOMA	CONCORDANT
106	979249	THICKENED WALL WITH CHRONIC INFLAMMATORY INFILTRATE	2:35PM	00:30:00	NO	NO	NO	FREE OF TUMOR	CONCORDANT
107	1184852	ENDOCERVICAL TISSUE	1:10PM	00:40:00	NO	NO	NO	BENIGN ENDOCERVICAL POYLP	CONCORDANT
108	1181334	REACTIVE HYPERPLAISA	1:45PM	00:35:00	NO	NO	NO	REACTIVE HYPERPLASIA	CONCORDANT
109	1181334	REACTIVE HYPERPLAISA	1:45PM	00:35:00	NO	NO	NO	REACTIVE HYPERPLASIA	CONCORDANT
110	1184377	FIBROFATTY TISUUE	3:10PM	00:45:00	NO	NO	NO	CHRONIC CERVICITIS	CONCORDANT
111	1184965	PAPILLARY EPITHELIAL NEOPLASM	3:10PM	00:30:00	NO	NO	YES	SEROUS CARCINOMA	CONCORDANT
112	1186092	CARCINOMA	3:40PM	00:35:00	NO	NO	YES	METASTATIC DEPOSITS	CONCORDANT
113	1182371	REACTIVE HYPERPLAISA	2:30PM	00:30:00	NO	NO	NO	REACTIVE HYPERPLASIA	CONCORDANT
114	1189215	TUMOR	12:00PM	00:40:00	NO	NO	YES	SQUAMOUS CELL CARCINOMA	CONCORDANT
115	1190119	METASTATIC DEPOSITS	12:35PM	00:35:00	NO	NO	YES	METASTATIC DEPOSITS	CONCORDANT
116	1190119	REACTIVE HYPERPLAISA	12:35PM	00:35:00	NO	NO	NO	REACTIVE HYPERPLASIA	CONCORDANT
117	1191450	NO TUMOR	12:05PM	00:35:00	NO	NO	NO	FREE OF TUMOR	CONCORDANT
118	1197837	CARCINOMA	12:40PM	00:30:00	NO	NO	YES	HIGH GRADE CARCINOMA	CONCORDANT
119	1196534	NO TUMOR	12:10PM	00:40:00	NO	NO	NO	FREE OF TUMOR	CONCORDANT
120	1199566	BENIGN CYSTIC LESION	1:35PM	00:35:00	NO	NO	NO	TORSION	CONCORDANT
121	1130609	FREE OF TUMOR	1:10PM	00:25:00	NO	NO	NO	FREE OF TUMOR	CONCORDANT
122	1200227	PARATHYROID ADENOMA	12:15PM	00:35:00	NO	NO	NO	PARATHYROID ADENOMA	CONCORDANT
123	1206547	OVARIAN STROMA WITH FEW HENOSIDERIN LADEN MACROPHAGES	1:15PM	00:40:00	NO	NO	YES	NORMAL OVARY TISSUE	CONCORDANT
124	1206950	MALIGNANT EPITHELIAL NEOPLASM	1:45PM	00:35:00	NO	NO	YES	CARCINOMA	CONCORDANT
125	1206950	MALIGNANT EPITHELIAL NEOPLASM	1:45PM	00:35:00	NO	NO	YES	CARCINOMA	CONCORDANT
126	1162449	NECROSIS	2:45PM	00:40:00	NO	NO	NO	GLIOBLASTOMA MULTIFORME	DISCORDANT
127	563460	REACTIVE HYPERPLAISA	11:40AM	00:35:00	NO	NO	NO	REACTIVE HYPERPLASIA	CONCORDANT
128	1215777	BENIGN CYSTIC LESION	12:45PM	00:30:00	NO	NO	NO	BRENNERS'S TUMOR	DISCORDANT
129	1172476	PROLIFERATIVE ENDOMETRIUM	1:35PM	00:30:00	NO	NO	NO	PROLIFERATIVE ENDOMETRIUM	CONCORDANT
130	1210697	NO TUMOR	2:40PM	00:30:00	NO	NO	NO	FREE OF TUMOR	CONCORDANT
131	1210697	NO TUMOR	2:40PM	00:30:00	NO	NO	NO	FREE OF TUMOR	CONCORDANT
132	1210697	NO TUMOR	2:40PM	00:30:00	NO	NO	NO	FREE OF TUMOR	CONCORDANT
133	1210697	NO TUMOR	2:40PM	00:30:00	NO	NO	NO	FREE OF TUMOR	CONCORDANT
134	1210697	NO TUMOR	2:40PM	00:30:00	NO	NO	NO	FREE OF TUMOR	CONCORDANT
135	1186626	BORDERLINE SEROUS TUMOR	3:10PM	00:40:00	NO	NO	NO	SEROUS CYSTADENOFIBROMA	DISCORDANT
136	1186626	REACTIVE HYPERPLAISA	1:40PM	00:30:00	NO	NO	NO	REACTIVE HYPERPLASIA	CONCORDANT
137	1214871	REACTIVE HYPERPLAISA	1:40PM	00:30:00	NO	NO	NO	REACTIVE HYPERPLASIA	CONCORDANT
138	1214871	NO TUMOR	2:45PM	00:45:00	NO	NO	NO	FREE OF TUMOR	CONCORDANT

Sr.No	MRD NUMBER	Prior intimation	AGE	SEX	FROZEN SECTION NUMBER	HISTOPATH NUMBER	TIME OF SPECIMEN RECEIVED	CLINICAL DIAGNOSIS	TYPE OF SPECIMEN	SITE OF SPECIMEN	INDICATIONS OF DOING FROZEN SECTION
139	1214871	YES	56	F	21-FS-155	21-11475	2:00PM	BASAL CELL CARCINOMA	SMALL	LATERAL MARGIN	RESECTED MARGIN STATUS
140	1214871	YES	56	F	21-FS-156	21-11475	2:00PM	BASAL CELL CARCINOMA	SMALL	SUPERIOR MARGIN	RESECTED MARGIN STATUS
141	1214871	YES	56	F	21-FS-157	21-11475	2:00PM	BASAL CELL CARCINOMA	SMALL	INFERIOR MARGIN	RESECTED MARGIN STATUS
142	1211428	YES	56	F	21-FS-158	21-11475	2:00PM	BASAL CELL CARCINOMA	SMALL	BASE	RESECTED MARGIN STATUS
143	1220589	YES	28	F	21-FS-159	21-11532	3:05PM	CA OVARY	LARGE	RIGHT ADENXAL MASS	PRIMARY DIAGNOSIS
144	1220589	YES	43	F	21-FS-160	21-11680,21-11681	2:40PM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
145	1219265	YES	43	F	21-FS-161	21-11680,21-11681	2:40PM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
146	1214712	YES	72	M	21-FS-162	21-11801,21-11771	11:40AM	GLIOBLASTOMA MULTIFORME	SMALL	RIGHT TEMPORAL SOL	PRIMARY DIAGNOSIS
147	1220972	YES	71	F	21-FS-163	21-11770	12:10PM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
148	1223762	YES	58	M	21-FS-164	21-11816	1:15PM	CA TONGUE	SMALL	LATERAL BORDER	PRIMARY DIAGNOSIS
149	1219254	YES	53	F	21-FS-165	21-11858	11:40PM	CA APPENDIX	LARGE	APPENDIX	PRIMARY DIAGNOSIS
150	1219254	YES	66	F	21-FS-166	21-11860	12:00PM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
151	1224511	YES	66	F	21-FS-167	21-11860	12:00PM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
152	1224511	YES	63	F	21-FS-168	21-11942	1:05PM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
153	1224511	YES	63	F	21-FS-169	21-11943	1:05PM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
154	33565	YES	63	F	21-FS-170	21-11944	1:05PM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
155	1159777	YES	47	F	21-FS-171	21-11947	2:05PM	CA OVARY	LARGE	OVARIAN MASS	PRIMARY DIAGNOSIS
156	1228267	YES	32	M	21-FS-172	21-12013	3:10PM	PARATHYROID ADENOMA	LARGE	PARATHYROID GLAND	PRIMARY DIAGNOSIS
157	1227040	YES	52	F	21-FS-173	21-12144	2:15PM	CA OVARY	LARGE	LEFT OAVRY	PRIMARY DIAGNOSIS
158	1230212	YES	60	F	21-FS-174	21-12262,21-12263	3:10PM	CHOLANGIOCARCINOMA	SMALL	NODULE IN LIVER	METASTASIS
159	146706	YES	70	M	21-FS-175	21-12277	1:10PM	CA TONGUE	SMALL	TONGUE BIOPSY	PRIMARY DIAGNOSIS
160	1230319	YES	65	F	21-FS-176	21-12357,21-12363	2:00PM	CA OVARY	LARGE	OVARIAN MASS	PRIMARY DIAGNOSIS
161	1230332	YES	36	F	22-FS-01	22-33,22-51	11:00AM	GLIOBLASTOMA MULTIFORME	SMALL	LEFT FRONTAL SOL	PRIMARY DIAGNOSIS
162	1233132	YES	57	F	22-FS-02	22-73	11:45AM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
163	1233132	YES	51	F	22-FS-03	22-126	11:00AM	RIGHT ADNEXAL MASS	LARGE	RIGHT OVARY	PRIMARY DIAGNOSIS
164	1234371	YES	51	F	22-FS-04	22-126	11:00AM	LEFT ADNEXAL MASS	LARGE	LEFT OVARY	PRIMARY DIAGNOSIS
165	1234371	YES	56	M	22-FS-05	22-164,22-165	1:25PM	CA GALL BLADDER	LARGE	GALL BLADDER	PRIMARY DIAGNOSIS
166	1199304	YES	56	M	22-FS-06	22-164,22-165	1:25PM	CA GALL BLADDER	LARGE	GALL BLADDER	PRIMARY DIAGNOSIS
167	1199304	YES	45	F	22-FS-07	22-195,22-194	4:10PM	CA PANCREAS	SMALL	PERITONEAL NODULE	METASTASIS
168	1223174	YES	45	F	22-FS-08	22-194,22-195	4:10PM	CA PANCREAS	SMALL	PANCRAETIC BODY MASS	PRIMARY DIAGNOSIS
169	1237326	YES	40	F	22-FS-09	22-309	11:30AM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
170	1244226	YES	60	F	22-FS-10	22-744,22-754	9:45AM	CA CERVIX	SMALL	CERVICAL BIOPSY	PRIMARY DIAGNOSIS
171	1244226	YES	69	M	22-FS-11	22-957	12:15PM	IPMN	SMALL	PANCREATIC DUCT MARGIN	RESECTED MARGIN STATUS
172	1220190	YES	69	M	22-FS-12	22-957	1:10PM	IPMN	SMALL	REVISED PANCREATIC DUCT MARGI	RESECTED MARGIN STATUS
173	1241332	YES	57	F	22-FS-13	22-973	12:10PM	PARATHYROID ADENOMA	SMALL	PARATHYROID GLAND	PRIMARY DIAGNOSIS
174	1250674	YES	43	F	22-FS-14	22-1035,22-1052	12:20PM	CA OVARY	LARGE	HYSTERECTOMY SPECIMEN	PRIMARY DIAGNOSIS
175	1184888	YES	72	F	22-FS-15	22-1083	11:30AM	DERMOID OVARIAN MASS	LARGE	OVARIAN MASS	PRIMARY DIAGNOSIS
176	1255924	YES	53	F	22-FS-16	22-1289	10:50AM	CA ESOPHAGUS	SMALL	NODULE	METASTASIS
177	1258063	YES	45	F	22-FS-17	22-1574,22-1586	12:30PM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
178	1258063	YES	36	F	22-FS-18	22-1704,22-1735	12:10PM	CA ENDOMETRIUM	SMALL	ENDOMETRIAL CURRETINGS	PRIMARY DIAGNOSIS
179	1257352	YES	36	F	22-FS-19	22-1704,22-1735	12:10PM	CA OVARY	LARGE	OVARIAN MASS	PRIMARY DIAGNOSIS
180	857261	YES	58	F	22-FS-20	22-1705,1709	12:40PM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
181	857261	YES	50	F	22-FS-21	22-1745	12:10PM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
182	1221670	YES	50	F	22-FS-22	22-1746	12:10PM	CA BREAST	SMALL	SENTINEL LYMPH NODE	METASTASIS
183	1236721	YES	60	F	22-FS-23	22-1816	10:05AM	HCC	SMALL	PERITONEAL NODULE	METASTASIS

Sr.No	MRD NUMBER	FROZEN SECTION DIAGNOSIS	TIME OF REPORTING	REVERT TIME	IMPRINT SMEAR PREPARATION (DONE/NOT DONE)	DEFFERRED CASE (YES/NO)	CHANGE IN SURGICAL MANAGEMENT (YES/NO)	FINAL HISTOPATHOLOGICAL DIAGNOSIS	CONCORDANT/ DISCORDANT
139	1214871	NO TUMOR	2:45PM	00:45:00	NO	NO	NO	FREE OF TUMOR	CONCORDANT
140	1214871	NO TUMOR	2:45PM	00:45:00	NO	NO	NO	FREE OF TUMOR	CONCORDANT
141	1214871	NO TUMOR	2:45PM	00:45:00	NO	NO	NO	FREE OF TUMOR	CONCORDANT
142	1211428	NO TUMOR	2:45PM	00:45:00	NO	NO	NO	FREE OF TUMOR	CONCORDANT
143	1220589	NECROSIS	3:45PM	00:40:00	NO	NO	NO	NON SEMINOMATOUS GERM CEL TUMOR YOLK SAC TUMOR	DISCORDANT
144	1220589	REACTIVE HYPERPLAISA	3:10PM	00:30:00	NO	NO	NO	REACTIVE HYPERPLASIA	CONCORDANT
145	1219265	REACTIVE HYPERPLAISA	3:10PM	00:30:00	NO	NO	NO	REACTIVE HYPERPLASIA	CONCORDANT
146	1214712	MALIGNANT NEOPLASM	12:10PM	00:30:00	NO	NO	YES	NECROSI WITH TINY TUMOR AREAS	DISCORDANT
147	1220972	METASTATIC DEPOSITS	12:40PM	00:30:00	NO	NO	YES	METASTATIC DEPOSITS	CONCORDANT
148	1223762	CARCINOMA	1:50PM	00:35:00	NO	NO	YES	SQUAMOUS CELL CARCINOMA	CONCORDANT
149	1219254	EXTRACELLULAR MUCIN WITH MUSCLE	12:15PM	00:35:00	NO	NO	NO	LOW GRADE APPENDICEAL NEOPLASM	DISCORDANT
150	1219254	METASTATIC DEPOSITS	12:35PM	00:35:00	NO	NO	YES	METASTATIC DEPOSITS	CONCORDANT
151	1224511	METASTATIC DEPOSITS	12:35PM	00:35:00	NO	NO	YES	METASTATIC DEPOSITS	CONCORDANT
152	1224511	REACTIVE HYPERPLAISA	1:35PM	00:30:00	NO	NO	NO	REACTIVE HYPERPLASIA	CONCORDANT
153	1224511	REACTIVE HYPERPLAISA	1:35PM	00:30:00	NO	NO	NO	REACTIVE HYPERPLASIA	CONCORDANT
154	33565	REACTIVE HYPERPLAISA	1:35PM	00:30:00	NO	NO	NO	REACTIVE HYPERPLASIA	CONCORDANT
155	1159777	OVARIAN STROMA WITH FEW HENOSIDERIN LADEN MACROPHAGES	2:40PM	00:35:00	NO	NO	NO	CORPUS ALBICANS,CORPUS LEUTUM HGICUM	CONCORDANT
156	1228267	PARATHYROID ADENOMA	3:40PM	00:30:00	NO	NO	NO	PARATHYROID ADENOMA	CONCORDANT
157	1227040	MALIGNANT EPITHELIAL NEOPLASM	2:45PM	00:30:00	NO	NO	YES	CARCINOMA	CONCORDANT
158	1230212	CHOLESTASIS WITH FEW GLANDS AND LYNPHOID AGGREGATE	3:40PM	00:30:00	NO	NO	NO	PROMINENT CHOLESTASIS	CONCORDANT
159	146706	SQUAMOUS CELL CARCINOMA	1:40PM	00:30:00	NO	NO	YES	SQUAMOUS CELL CARCINOMA	CONCORDANT
160	1230319	MALIGNANT EPITHELIAL TUMOR	2:35PM	00:35:00	NO	NO	YES	ADENOCARCINOMA	CONCORDANT
161	1230332	HIGH GRADE ASTROCYTOMA	11:40AM	00:40:00	NO	NO	YES	DIFFUSE ASTROCYTOMA	CONCORDANT
162	1233132	METASTATIC DEPOSITS	12:20PM	00:35:00	NO	NO	YES	METASTATIC DEPOSITS	CONCORDANT
163	1233132	NO EVIDENCE OF MALIGNANCY	11:45AM	00:45:00	NO	NO	NO	ENDOMETRIOSIS	CONCORDANT
164	1234371	NO EVIDENCE OF MALIGNANCY	11:45AM	00:45:00	NO	NO	NO	ENDOMETRIOSIS	CONCORDANT
165	1234371	SUSPICIOUS OF MALIGNANCY	2:00PM	00:35:00	NO	NO	NO	FREE OF TUMOR	DISCORDANT
166	1199304	NO TUMOR	2:00PM	00:35:00	NO	NO	NO	FREE OF TUMOR	CONCORDANT
167	1199304	ADENOCARCINOMA	4:35PM	00:25:00	NO	NO	YES	METASTATIC DEPOSITS	CONCORDANT
168	1223174	HIGHLY SUSPICIOUS OF MALIGNANCY	4:35PM	00:25:00	NO	NO	YES	DUCTAL ADENOCARCINOMA	CONCORDANT
169	1237326	REACTIVE HYPERPLAISA	12:05PM	00:35:00	NO	NO	NO	REACTIVE HYPERPLASIA	CONCORDANT
170	1244226	SQUAMOUS CELL CARCINOMA	10:27AM	00:42:00	NO	NO	YES	SQUAMOUS CELL CARCINOMA	CONCORDANT
171	1244226	HIGH GRADE DYSPLASIA	12:51PM	00:36:00	NO	NO	YES	HIGH GRADE DYSPLASIA	CONCORDANT
172	1220190	NO TUMOR	1:55PM	00:45:00	NO	NO	NO	FREE OF TUMOR	CONCORDANT
173	1241332	PARATHYROID ADENOMA	12:45PM	00:35:00	NO	NO	NO	PARATHYROID ADENOMA	CONCORDANT
174	1250674	PAPILLARY SURFACE EPITHELIAL NEOPLASM? BORDERLINE? INVASIVE	12:55PM	00:35:00	NO	NO	YES	SEROUS BORDERLINE TUMOR	CONCORDANT
175	1184888	MATURE CYSTIC TERATOMA	12:10PM	00:40:00	NO	NO	YES	OVARIAN STROMA WITH CORPUS ALBICANS	CONCORDANT
176	1255924	AREAS OF SCLEROSIS	11:25AM	00:35:00	NO	NO	NO	FREE OF TUMOR	CONCORDANT
177	1258063	METASTATIC DEPOSITS	12:50PM	00:20:00	NO	NO	YES	METASTATIC DEPOSITS	CONCORDANT
178	1258063	COMPLEX HYPERPLAISA	12:45PM	00:35:00	NO	NO	YES	ENDOMETRIOID CARCINOMA	DISCORDANT
179	1257352	ATYPICAL SQUAMOUS PROLIFERATION	12:40PM	00:30:00	NO	NO	YES	ENDOMETRIOID CARCINOMA	DISCORDANT
180	857261	REACTIVE HYPERPLAISA	1:00PM	00:20:00	NO	NO	NO	REACTIVE HYPERPLASIA	CONCORDANT
181	857261	REACTIVE HYPERPLAISA	12:50PM	00:40:00	NO	NO	NO	REACTIVE HYPERPLASIA	CONCORDANT
182	1221670	REACTIVE HYPERPLAISA	12:50PM	00:40:00	NO	NO	NO	REACTIVE HYPERPLASIA	CONCORDANT
183	1236721	ADENOCARCINOMA	10:45AM	00:40:00	NO	NO	YES	METASTATIC DEPOSITS	CONCORDANT

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Date 5/1/22

The Principal,
DMC, Ludhiana.

Subject: **Approval of Plan of Thesis.**

This is to inform you that the Faculty of Medical Sciences in its meeting held on 29.10.2021 has approved the plan of thesis of **Devika Bansal,** a student of your college for **MD Pathology** along with the names of Supervisor/Co-Supervisor as under:-

Topic Plan of Thesis
Correlation of intraoperative frozen section with histopathology.

Supervisor
Dr. Bhavna Malhotra
Prof.,
Dept. of Pathology,
DMCH, Ludhiana.

Co-Supervisor

Dr. Harpreet Kaur
Prof. & Head,
Dept. of Pathology,
DMCH, Ludhiana.

Dr. Gurpreet Singh Brar
Prof. & Head,
Surgical Oncology Unit,
DMCH, Ludhiana.

The student has to submit the four copies of thesis (along with PDF format) , to the Controller of Examinations, BFUHS, Faridkot, at least six months before the commencement of theory examination, if he/she is otherwise eligible to take the examination. He /She must directed to attach a photocopy of this letter with the forwarding letter while submitting thesis to the University along with the letter of approval of University for change of supervisor/Co-Supervisor, change of topic,(if any).

Dr. S P Singh MS(Oph)
Controller of Examinations

Note :

93. *If any discrepancy found regarding topic of thesis or Supervisor/Co-Supervisor, inform undersigned within one month after issue of this letter.*
94. *The student may submit the thesis as per the schedule already conveyed i.e for May/June examination 30th Nov of the preceding the year of examination and for Nov/Dec examinations 31st May of the year of examination.*

CORRELATION OF INTRA-OPERATIVE FROZEN SECTION WITH HISTOPATHOLOGY

THESIS PROPOSAL

FOR APPROVAL OF SUBJECT OF THESIS TO BE SUBMITTED IN

PARTIAL FULFILMENT OF THE REQUIREMENTS

FOR THE DEGREE OF

MD

In

PATHOLOGY

OF THE

BABA FARID UNIVERSITY OF HEALTH SCIENCES

FARIDKOT

MARCH, 2021

DR. DEVIKA BANSAL

DEPARTMENT OF PATHOLOGY
DAYANAND MEDICAL COLLEGE AND HOSPITAL
LUDHIANA

ABSTRACT OF PLAN OF THESIS

Title	CORRELATION OF INTRAOPERATIVE FROZEN SECTION WITH HISTOPATHOLOGY
For the degree of	MD (PATHOLOGY)
Name of the candidate	Dr. Devika Bansal
Supervisor	Dr.Bhavna Malhotra, Professor, Department of Pathology, DMCH, Ludhiana
Co-supervisor(s)	Dr.Harpreet Kaur, Professor and Head , Department of Pathology, DMCH, Ludhiana Dr.Gurpreet Singh Brar, Professor and Head , Surgical Oncology Unit, DMCH, Ludhiana
Institution	Dayanand Medical College and Hospital, Ludhiana
University	Baba Farid University of Health Sciences, Faridkot

Introduction: Tissue specimens taken from the patient during the surgery (frozen section) will be studied and then correlated with the final histological examination.

Aims & Objectives: To study the indications of doing frozen sections in our institute and to compare the diagnostic accuracy of frozen section in various tissues by comparing it with histological examination.

Material & Methods: This study will be conducted in the Department of Pathology at Dayanand Medical College and Hospital, Ludhiana for a period of 1 year prospectively (1st March 2021- 28th Febrauary 2022). Fresh tissue sent for frozen section examination, will be examined grossly, specimen will be dissected and sections will be taken from representative areas. Frozen sectioning will be done on cryostat a cabinet cooled to -20 to -30 degree Celsius and enclosing a microtome blade. The cryostat will be set at a temperature range depending upon the nature of the tissue. Sections will be cut at a thickness of 4-6 micron and will immediately be stained with rapid haemotoxylin and eosin (H&E) stain and Toludine blue stain. Frozen section diagnosis will be made and immediately conveyed to the operating surgeon.

Subsequently, for the permanent section, left over tissue specimen will be fixed in 10% of formalin, grossed and adequate representative sections will be taken and processed. The sections will then be stained with haemotoxylin and eosin (H&E) stain. The frozen section diagnosis will be compared to that of the permanent sections to assess the accuracy of the technique.

Clinical Significance: To obtain a good database for accuracy of the diagnosis of frozen section by comparing it with the histological findings.

Keywords: Frozen section, Histological, Accuracy

(Signature)	(Signature)	(Signature)	(Signature)	(Signature)
Candidate	Co-supervisor	Co-supervisor	Supervisor	Principal

CERTIFICATE OF FACILITIES AVAILABLE

This is to certify that the facilities for work on the subject of thesis titled **"CORRELATION OF INTRAOPERATIVE FROZEN SECTION WITH HISTOPATHOLOGY"** exist in the Department of Pathology, DMC&H, Ludhiana and will be provided to the candidate. We will see that the data being included in the thesis is genuine and is collected by the candidate herself under our supervision and guidance.

Supervisor

Dr. Bhavna Malhotra
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Co-Supervisors

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Place : LUDHIANA
Date : 16/3/21

APPROVAL PROFORMA
BY RESEARCH & ETHICAL COMMITTEE
DAYANAND MEDICAL COLLEGE & HOSPITAL, LUDHIANA

Name of candidate	Dr. Devika Bansal
Department	Pathology
Topic of Thesis	CORRELATION OF INTRAOPERATIVE FROZEN SECTION WITH HISTOPATHOLOGY
Likely date of appearing in PG examination	May 2023
Date of enrollment	25th July, 2020
Name of Head of Department	Dr. Harpreet Kaur
1) Supervisor **2) Co-Supervisor(s)**	Dr. Bhavna Malhotra Dr. Harpreet Kaur Dr. Gurpreet Singh Brar
Signature of Members of Research Committee with Stamp	**Signature of Members of Ethics Committee with Stamp**
Dr. Harpreet Kaur (Professor & Head, Pathology)	Mr. R K Sharma (Legal Expert)
Dr. Jaspal Singh (Professor & Head, Surgery)	Dr. Ramit Mahajan (Associate Professor, Gastroenterology)
Dr. Dinesh Gupta (Professor & Head, Medicine)	Dr. Anu Sharma (Professor, Anatomy)
Dr. Sandeep Kaushal (Dean Academics & Professor & Head, Pharmacology)	Dr. Sandeep Kaushal (Dean Academics & Professor & Head, Pharmacology)
Dr. Gurpreet S Wander (Vice Principal)	Dr. Gurpreet S Wander (Vice Principal & Professor & Head, Cardiology)
	Dr. Gagandeep Singh (Secretary, Ethics Committee Professor & Head, Neurology)

Approved: Yes / No

Dr. Sandeep Puri
Chairperson
Research Committee

Approved: Yes / ~~No~~

Prof. Arvind Malhotra
Chairperson
Ethics Committee

BABA FARID UNIVERSITY OF HEALTH SCIENCES, FARIDKOT

PROFORMA FOR REGISTRATION OF SUBJECT FOR DISSERTATION

1	NAME OF THE CANDIDATE AND ADDRESS	Dr. Devika Bansal G-001, Gillco Towers, Gillco Valley, Sector-127, Kharar (Punjab) 140301
2	NAME OF THE INSTITUTE	Dayanand Medical College and Hospital, Ludhiana
3	COURSE OF STUDY AND SUBJECT	MD Pathology
4	DATE OF ADMISSION OF COURSE	25-07-2020
5	TITLE OF THE TOPIC	CORRELATION OF INTRAOPERATIVE FROZEN SECTION WITH HISTOPATHOLOGY

6. BRIEF RESUME OF THE INTENDED WORK

6.1 NEED FOR THE STUDY

Tissue specimen taken from the patient by doing a biopsy or a surgery is usually assessed by the pathologist on the following day after the specimen is adequately fixed in formalin. However, occasionally surgeons need pathologic information more urgently thus, they request for an intra-operative consultation on the tissue that is being taken out (also known as frozen section). This involves gross inspection and, if it is a larger specimen, dissection is performed. In order to cut thin sections thickness of < 1 cell for microscopic evaluation, tissues must be hardened. Freezing tissue is rapid method that can be used to harden tissue sufficiently to allow thin sectioning. Sections will be cut at a thickness of 4-5 micron and will immediately be stained with rapid haemotoxylin and eosin (H&E) stain and Toludine blue stain. Frozen sectioning will be done on cryostat a cabinet cooled to -20 to -30 degree Celsius and enclosing a microtome blade.[1-4] The examination is made while the patient is on the operating table.[5] Subsequently, for the permanent section, left over tissue will be fixed in 10% of formalin, grossed, adequate representative sections will be taken and processed. The sections will then be stained with haemotoxylin and eosin (H&E) stain. The frozen section diagnosis will be compared to that of the permanent sections to assess the accuracy of the technique. The examination report of frozen section is then conveyed as soon as possible to the operating surgeon via telephone or intercoms as the result will greatly influence the surgeon's intra-operational decision. The pathologist has to arrive at a correct decision in a shorter duration under pressure based on his experience, judgement and the knowledge of his speciality and clinical medicine and also there are staining problems as well.

Reasons for doing frozen section are many which are summarized below.

To establish the nature of a lesion which needs to be resected is neoplastic or nonneoplastic and further whether it is benign or malignant

is very important to the operating surgeon, as this will decide the type of operative procedure or further sampling that has to be made.

To establish the presence of a lesion or skip lesion in surgically suspicious tissue area and to ascertain the presence of another lesion spotted unexpectedly during an operation.

To determine the adequacy of margins is very important in a case of malignant tumour. If the resected margins are positive the surgical procedure is not considered to be adequately performed.

To establish the evidence of invasion to the lymph nodes and nerve. It is also sometimes used to ascertain metastasis to distant organs.

To determine the etiology of nonneoplastic lesions and to look for the presence of tissue inflammation, granulomas and fungal infection.

This present study is intended to know the various indications of doing frozen section in our institute and to determine the accuracy of frozen section by correlating it with final histopathology report.

6.2 REVIEW OF LITERATURE

Lang apparently first employed the use of freezing to harden tissues in the nineteenth century. De Riemer in 1818 made the pioneering effort of using FS technique for histopathological diagnosis. With the advancement of a modern reliable FS technique, intra-operative problems could be addressed immediately. This practice has since then evolved especially after development of cryostat in 1959.[6] Interestingly, this development placed the pathologist back on the operating room team where he originated.[7]

Frozen section (FS) technique was first introduced by the William H. Welch, from John Hopkins Hospital in 1891.[8] The technique introduced by Hazard and Stevenson in 1949 is fascinating compared to modern procedures using the cryostat, in which the fresh specimen was placed in a fixative ten times its volume and heated to about just the boiling point. The fixed block was then frozen between pieces of dry ice and cut at 10–15 um with a microtome knife. Each section was transferred to a beaker of distilled water. The section was then carried by a glass rod into a beaker containing carbol fuschin and toluidine blue solution. After repeated washing in a series of beaker containing distilled water, the section was mounted onto a clean glass slide and immediately covered with cover slip.

Teloh HA basically perfected the technique in 1957 by directly placing the unfixed specimen onto the freezing stage of the microtome and subjected the tissue to intermittent release of carbon dioxide gas causing rapid freezing, then cutting the tissue at 25um and stained using a drop of aqueous thionin solution. For permanent section, Teloh suggested the section to be subjected to a few drop of 95% alcohol and stained using the haematoxylin and eosin (H&E) technique used for paraffin embedded tissue section. The accuracy rates for frozen section are well published in western literature.[9-15]

A retrospective analysis by Shretha S et al done in year 2009 of 404 cases of frozen section on various tissue specimens showed accuracy of frozen section as 94.6% with false positive rate of 1.5% and false negative rate of 3.9% . 3.9% cases were of deferred diagnosis. The retrospective study divided the diagnostic errors related to intraoperative consultation into interpretation error (57%), sampling errors (35%) and lack of interdepartmental communication (8%). The causes of false positive diagnosis were due to interpretation error which occurred due to artifacts from freezing procedure and rarity of the lesion . Sampling error was the reason for false negative diagnosis. In 3.9% of cases, diagnosis was deferred to permanent sections mainly due to lack of adequate clinical information and inadequate material. The most common indication of frozen section encountered was verification of type of neoplasm (360/404), assessment of margins (120/404) and for nodal status (93/404).[8]

Study by Parikshit Patil et al done in the year 2015 of 100 frozen section cases showed an accuracy of 96.96% with false positive and false negative rates of 1.01% and 2.02% respectively and 01% case was deferred for permanent paraffin sections. The deferred case specimen was from pancreas and it was deferred due to inadequate material. Sensitivity, specificity, PPV and NPV were 97.22%, 96.03%, 98.59% and 92.86% respectively. The most common indications for frozen section was observed to be primary diagnosis (55%), assessment of margins of tumour excision (34%) and assessment of nodal status (11%) mostly in breast and oral malignancies.[5]

Study by Hossein Hatami et al done in the year 2015 of 306 frozen section specimens of which 289 cases (97.96%) were concordant to the permanent diagnosis and 6 cases (2.03%) were discordant. 2 cases out of 6 discordant cases were due to sampling error and 4 cases were due to interpretation errors. Specimens were primarily from the head and neck, thyroid, ovary, parathyroid and lymph nodes. The sensitivity, specificity, PPV, NPV were 92.95%,99.55%, 98.50%, 97.80% respectively and 3.59% cases were deferred diagnosis.[16]

Study by Saumya Mishra et al done in the year 2016 of 67 frozen section specimens showed an accuracy of 96.2%. 2 cases were discordant with false negative diagnosis which were specimens from gall bladder and thyroid. The primary indication was presence/typing of neoplasm in 44 cases, clearance of margins in 7 cases and to determine presence of ganglion cells in one case of Hisrchsprung disease. The discrepancy was attributed to misinterpretation error (1.92%) and sampling error (1.92%)[17]

Study by Dr.Argha Baruah et al done in the year 2018 of 84 frozen section showed an accuracy of 95.81%. Sensitivity, specificity, PPV, NPV were 92.7%, 98.8%, 98.7%, 93.2%. The common indications for frozen section in this study was confirmation of primary diagnosis-benign/malignant (87%), surgical margin involvement (4%) and assessing nodal status and skin involvement in malignancies (9%). Out of 84 cases 91.6% cases were concordant and 8.4% cases were discordant. The maximum discordance in cases were in neuropathological specimens. The reasons for discordance was sampling error and interpretation error.[18]

Study by Dr. Pragati Prabhakar rao phulgirkar et al done in the year 2018 of 75 frozen section showed an accuracy of 90.7%, with false negative rate of 4% and 5.3% cases of inconsistent diagnosis which was due to lack of adequate clinical information and inadequate material. The common limitation experienced was freezing artifacts. The primary indication of frozen section was observed to be presence /typing of neoplasm.[19]

Study by Rafeal P. Santana et al done in the year 2018 of 1226 frozen section cases showed an accuracy rate of 96.3%, 1181 (96.33%) were concordant, 45 (3.67%) were discordant. The tissue that had most false positive results was mammary sentinel lymph node. The reasons for discrepancy were sampling error, misunderstanding and complexity of the diagnosis.[20]

Study by Hiral Samir Shah et al done in year 2019 of 264 frozen section cases showed an accuracy rate of 97.3%. Seven cases were discordant (2.7%) with three cases reported as false negative (1.1%)

and four cases as false positive (1.5%). The most common indications of frozen section was adequacy of margins, presence /typing of neoplasm.[21]

Diagnostic discrepancies between frozen and permanent section are commonly observed in tissue from skin, breast, uterine cervix and thyroid.[22-26]

6.3 AIMS AND OBJECTIVES OF THE STUDY

1. To study the indications of doing frozen sections.
2. To Compare diagnostic accuracy of frozen section obtained by comparing with histological examination of the specimen.

7. MATERIALS AND METHODS

7.1 Source of Data

All the frozen section tissues of all the organs received in the Department of Pathology of Dayanand Medical College and Hospital, Ludhiana over a period of 1 year prospectively (1st Mrach 2012- 28th February 2022) and they will be compared with histological sections.

7.2 METHOD OF COLLECTION OF DATA

INCLUSION CRITERIA

All frozen sections received in the pathology department

EXCLUSION CRITERIA

All the histopathological specimen for which frozen section was not sent.

PROCEDURE

For prospective study fresh tissue sent for frozen section examination, will be examined grossly, specimen will be dissected and sections will be taken from representative areas. Frozen sectioning will be done on cryostat. The cryostat will be set at a temperature range depending upon the nature of the tissue. Sections will be cut at a thickness of 4-5 micron and will immediately be stained with rapid haemotoxylin and eosin (H&E) stain and Toludine blue stain. Frozen section diagnosis will be made and immediately conveyed to the operating surgeon.

Subsequently, for the permanent section, left over tissue will be fixed in 10% of formalin, grossed, adequate representative sections will be taken and processed. The sections will then be stained with haemotoxylin and eosin (H&E) stain. The frozen section diagnosis will be compared to that of the permanent sections to assess the accuracy of the technique.

For retrospective cases, the slides will be reexamined and evaluated as per proforma.

DURATION OF STUDY

One year prospective study from 1st March 2021- 28th Febrauary 2022 will be done.

OUTCOME

All the frozen section slides and the corresponding histopathological specimen slides will be analysed in this study. The frozen section diagnosis will be correlated with the histological diagnosis.

STATISTICAL ANALYSIS

Data will be described in terms of range; mean ±standard deviation (± SD), frequencies (number of cases) and relative frequencies (percentages) as appropriate. Sensitivity, specificity, accuracy, positive predictive value, and negative predictive value will be calculated. A probability value (p value) less than 0.05 will be considered statistically significant. All statistical calculations will be done using (Statistical Package for the Social Science) SPSS 21version (SPSS Inc., Chicago, IL, USA) statistical program for Microsoft Windows.

7.3 DOES THE STUDY REQUIRE ANY INVESTIGATIONS OR INTERVENTIONS TO BE CONDUCTED ON PATIENTS OR OTHER HUMANS OR ANIMALS? IF SO, PLEASE DESCRIBE BRIEFLY.

No.

7.4 HAS ETHICAL CLEARANCE BEEN OBTAINED FROM YOUR INSTITUTION IN CASE OF 7.3?

Attached herewith

LIST OF REFERENCES

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PROFORMA

Sr. No. _____

Prior intimation of Frozen section (Yes/No):

Name :

Age:

MRD No.:

Sex:

Frozen Section No:

Date and Time:

Histopath No.:

Address :

Time of Specimen Received:

Clinical History:

Biochemical/Pathology/Microbiological Investigations(If any):

- Hemogram:
- Tumour Markers:
  - CA-125
  - CA 19-9
  - CEA
  - AFP
  - LDH
  - Beta HCG
- Cultures(Blood /Urine):

Radiological Investigation(USG/MRI/CT scan):

- Size:
- Location:
- Number of lesions:
- Mass:
- Calcification:

Clinical Diagnosis:

Radiological Diagnosis:

Signature of candidate

Signature of Supervisor

Type of Specimen(Large Specimen/Small Specimen):

Site of Specimen:

Indications of doing Frozen section:

- Presence of the lesion
- Nature of lesion (Benign/Malignant)
- Resected Margins
- Evidence of invasion
- Infection
- Others

Gross examination:

- Specimen Inked/Sutures (present/not present):
- Size of the lesion:
- Location of the lesion:
- Consistency of the tissue(Hard/Firm/Rubbery/Soft):
- Capsule (Present/Not present)
- On Cut Section:
    - Architectural appearance of the lesion:
    - Solid/Cystic Areas (present/not present):
        - If cystic color and consistency of the fluid:
    - Areas of Necrosis (present/not present):
    - Hemorrhagic areas (present/not present):
- Others (If Any):

Frozen section cutting temperature range:

Signature of candidate

Signature of Supervisor

Microscopic examination:

- Normal Anatomical tissue (present/not present):
- Borders of the lesion (encapsulated/well circumscribed/poorly circumscribed/infiltrative/pushing borders)
- Epithelium (intact/eroded):
- If Infective/Inflammatory pathology:
    - Areas of necrosis (present/not present):
    - Ares of hemorrhage (present/not present):
    - Inflammatory infiltrate (Acute/Chronic):
    - Granulomas (present/not present):
    - Multinucleated giant cells (present/not present):
    - Organism (bacteria/fungus) If any:
    - Background:

- If Tumor pathology:
    - Patterns of Arrangement of tumor cells:
    - Anaplasia (present/not present):
    - Individual tumor cell:
    - Necrosis and hemorrhage (present/not present):
    - Calcification (present/not present):
    - Angioinvasion (present/not present):
    - Capsular invasion (present/not present):
    - Stroma:
    - Special features (mucin/keratin pearls/granulomas/etc):

- Resected Margins (Involved/Not involved):
    - Malignant cells (present/not present):

- Other Feature (if any):

Frozen section diagnosis:

Signature of candidate

Signature of Supervisor

Time of reporting:

Imprint Smear Preparation (done/not done):

- If done then Impression of the same:

Deferred case (Yes/No):

Reasons for Deferred Diagnosis:

- Freezing artifacts:
- Tumour necrosis:
- Sample inadequate:
- Others:

Change in Surgical Management (Yes/No) :

- If yes then what:

Final histopathological diagnosis:

Concordant/Discordant:

Reason for discordant diagnosis:

- Sampling error
- Interpretation error
- Communication Problem
- Others

Signature of candidate

Signature of Supervisor